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November 1982

Primavera (p.58)

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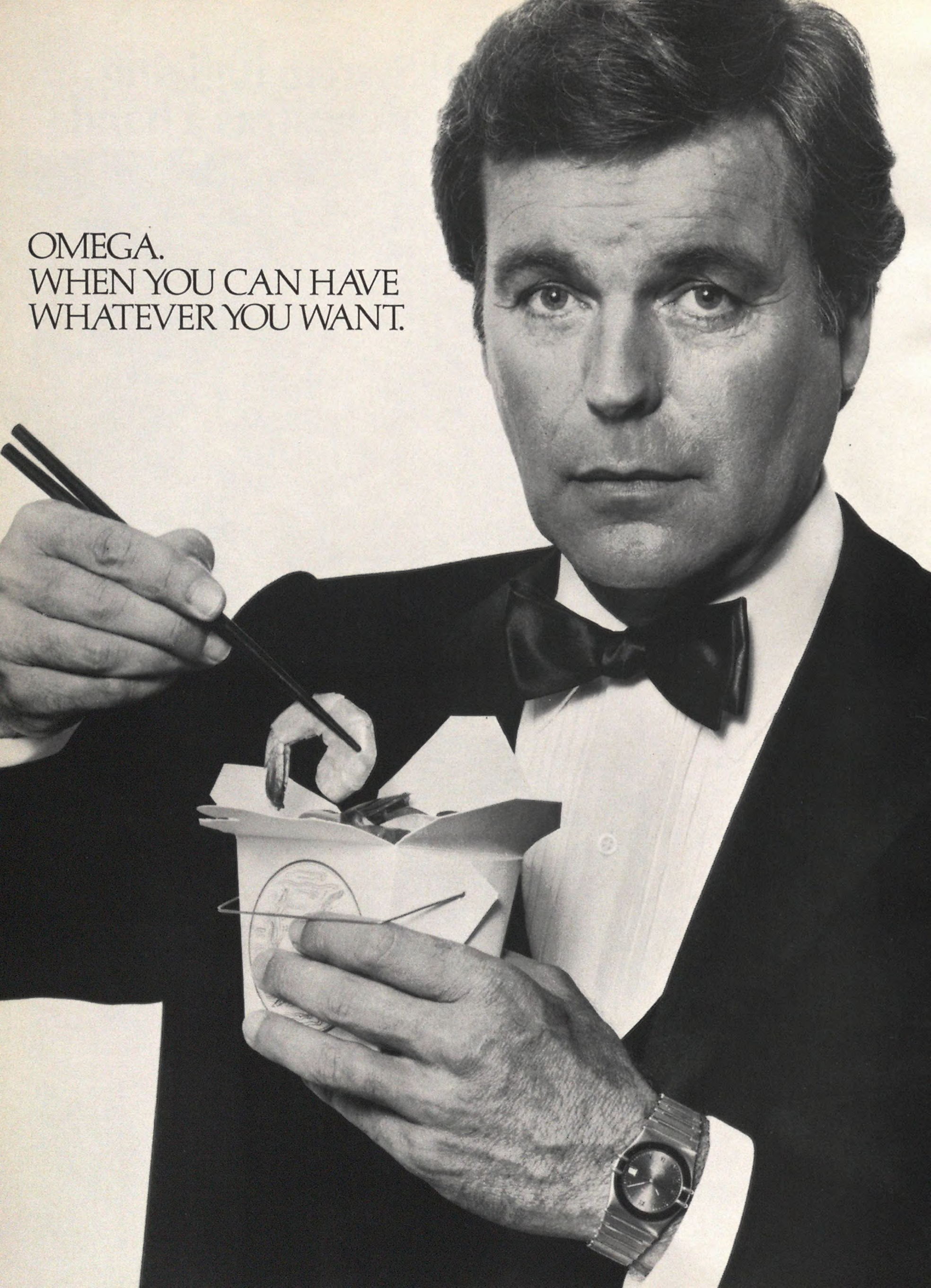

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Volume 13, Number 8

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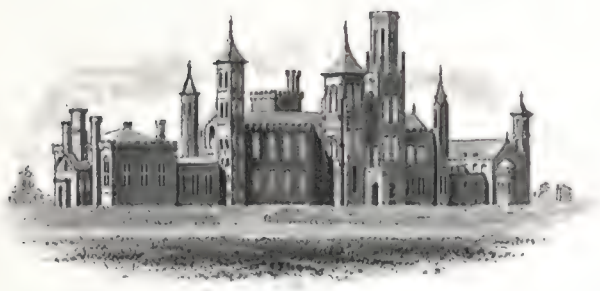

To survive, we need to better understand Asia, Africa and the Near East—which is the main reason for our 'Quadrangle' project

The news that Dr. Arthur M. Sackler, the celebrated art collector, has pledged a thousand items from his major Asian and Near Eastern collections, with the addition of $4 million toward construction of a new facility at the Smithsonian, is a stunning example of looking toward the future. The fact that our proposed Center for African, Near Eastern and Asian Cultures —with its concomitant museums, seminar rooms and educational outreach programs—is proceeding on course is a further example that no matter what today's headlines, it is incumbent on the Smithsonian to be thinking of tomorrow's promise.

Five years from now, surely, the problems of the Middle East will have been solved or we will have sunk without trace. It is necessary, even vital, to the future of communication and of the striving for peace and mutual understanding that we should maintain an attitude of determination and optimism. I am convinced that the Smithsonian's "Quadrangle" plans, as they are called, transcend the present and point toward the future in a compelling manner. We must keep our sights on the future, just as we must keep our cool at the present. The sums of money involved in creation of the Quadrangle are not great, but the stakes are enormous. Better understanding of Asia and the Middle East—that vast area which encompasses more than half of the world's population and on which so much of our economy and mutuality depend—is essential for Americans, even though involvement in developments there may not be wholly welcome to us who live day-to-day in our own setting and in our own country. It has always been confusing to follow current events in the newspapers; nowadays it is always depressing. How can we raise our sights, then?

Certainly it is one of the responsibilities of our Institution, chartered for the "diffusion of Knowledge among men," to keep a steady course even when political and military events sweep over us like simooms. The sands of the desert have buried kingdoms and empires of the past. We are once again in the midst of agonies of war, bestiality, terrorism and brutality such as have not plagued the Middle East since perhaps the time of the Crusades. How ironic that the Crusaders, in their attempts to free the Holy Land, perpetrated many of the horrors that are today being reenacted in that fountainhead of three of the world's great religions. Must religious passion still evoke the same insensate lusts for terror and killing that they did all those centuries ago?

It would be a marvelous thing to be able to assume that evolution proceeds in the human spirit at the same level and to the same degree as in technology. But it seems as though the amenities available to many of us today do little to increase our perceptions of life as it should be lived around the planet. Shouldn't progress connote cultural evolution as well?

Meanwhile, we here at this great Institution are enormously encouraged by the attitudes of those clear thinkers around us who agree that the future is indeed of transcending importance compared with the buffetings and emergencies of the present. Let us hope that we can come at last into a time of clear sailing and clear thinking in the very near future.

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Letters to the Editor

Animal shelters

Dear Sir: Your September article by Patricia Curtis overlooked a problem that threatens the credibility of animal shelters and their ability to humanely and effectively carry out their responsibilities.

Laws exist in several states requiring or allowing animal shelters to relinquish animals in their custody to laboratories for experimentation, thereby placing facilities established for the protection of animals in the untenable position of being storage houses for the laboratories. This perverts the purpose of shelters, and serves to discourage people from bringing them animals and from contributing money to the humane societies that operate them. As a result, unwanted animals are often left to suffer and reproduce in our streets.

The issue is not whether animal experimentation is justified, but whether animal shelters should be forced or allowed to sacrifice their ability to humanely and effectively deal with the unwanted animal population.

Fortunately, efforts to repeal what have been referred to as "pound seizure" laws have been successful in some states, including New York. These efforts must continue to assure that animal shelters do not betray both the animals entrusted to them and the public's trust.

Elinor Molbegott
General Counsel, ASPCA
New York City

Dear Sir: We would like to add, as a footnote to your article, the story of Richard Martin, M.P., of Ballinahinch, County Galway, who, in 1822, fought through Parliament a bill, later known as Martin's Act, for the protection of animals. It was

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He also happened to be our great-great-grandfather.

Florence E. Martin
Grimsby, Ontario
Barbara Martin Bensen
Damariscotta, Maine

Humanity Dick with his animals

Dear Sir: One aspect of the surplus pet problem insufficiently emphasized by Miss Curtis is that overpopulation is caused by people's failure to control their pets' reproductive lives. Altered animals are better pets—they are more human-oriented, stay closer to home and are less inclined to fight. Recent research indicates that neutering tends to reduce the incidence of prostate problems in male dogs and cats and spaying that of cancer

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in females. Contrary to folklore, a female animal's disposition is not improved by having borne a litter. And people who want their children to witness the "miracle of birth" should give some thought to the "miracle of death," as described in your article, as well.

My version of pet utopia would be populated by responsible owners who would have such a high percentage of their pets neutered that nonpedigreed kittens and puppies would be rare enough to sell for $10 and $20 apiece. Maybe that would make us realize that these little lives are valuable and deserve —at the very least—humane treatment.
Rosalie Parke
Seattle

Dear Sir: With reference to Patricia Curtis' interesting article on animal shelters, it was not George Angell who published the first edition of Anna Sewell's *Black Beauty*, but Jarrolds' in London, in 1877. Angell did publish the first American edition—after staying up all night to finish reading it. He even ran contests for comparable novels about other domestic animals. *Beautiful Joe*, by Marshall Saunders, was one of the winners.
Ellen B. Wells
Smithsonian Institution Libraries
Washington, D.C.

Horses of San Marco

Dear Sir: The golden horses have been favorites of mine for years and your article reminded me of a bus tour in Istanbul several years ago. As we were going through a park our tour guide pointed out a spot and said: "That is where our four horses used to be before the Italians took them away from us." It took considerable restraint on my part to refrain from saying, "Well, you got them in a similar way in the first place."
Isabelle Kehlor
Newport Beach, California

Dear Sir: Ann Pearce's stimulating article tells me for the first time that the horses of San Marco had bits—borne out by the cover picture, which shows the corners of the mouth drawn back and creased, as by a bit. But a bit needs something to hold it in place, and I seem to see a ghostly bridle, also what appear to be rivet holes in the cheek and mouth corner. There is also a much larger hole

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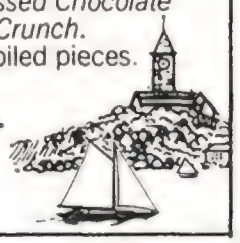

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just above the joint in the collar. I am guessing at a checkrein either from the cheek or bit to the collar. The horses' heads are certainly pulled in by force. Then, the Bellini painting shows pendants to the collars. What is the story?
M. M. Graff
Brooklyn, New York
According to Anna Guidi Toniato's descriptive analysis of the horses, the two small holes you noticed held nails attaching harness straps to the head. Because the horses were not gilded until the separately cast harness had been fixed in place, your "ghostly" image traces the lost trappings. Today's ornamental studs on the collars are substitutes for the flowers and roses visible in 18th-century drawings but lost during the horses' Paris sojourn. And the Bellini indicates that the present collars are probably replacements, as those he painted appear to be pointed rather than circular. Ed.

Dear Sir: An unfortunate error crept into your excellent article on the horses of San Marco. You say that at the time of the Fourth Crusade Venice was ". . . the same empire that had sent Marco Polo on his way to distant China. . . ." Now, Marco Polo was born about 50 years after this crusade, and his trip to China was made a number of years later still.
Frank M. Chambers
Tucson
You are correct. Ed.

William Blake

Dear Sir: Edward Lucie-Smith's excellent article was warmly welcomed in this household, where Blake's work has been long in residence.

As it was in the 1780s, which introduced the Industrial Revolution, that Blake was beginning his life's work it is fitting that he appeal so directly to us in the 1980s, the decade which is heralding the beginning of the electronic revolution.

In addition to his first American retrospective in 40 years, other notice is being taken of the artist. This year the most prestigious American children's book honor, the Newbery Award, went to Nancy Willard's fanciful *A Visit to William Blake's Inn*—the first such award to a volume of poetry. It is the first book to be cited, as well, as a Caldecott honor book (for its illustrations by Alice and Martin Provensen).

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With all these tributes it is nice to contemplate Blake, that visionary genius, perhaps somewhere watching and enjoying all the fuss being made over him.
Barbara Lucas
Madison, New Jersey

T. S. Eliot's cats

Dear Sir: Israel Shenker's article about the new production based on Eliot's *Old Possum's Book of Practical Cats* prompted us to replay our Angel recording of the delightful earlier arrangement of six of the original poems. They were selected by Alan Rawsthorne for his entertainment for children, *Practical Cats*, commissioned by the Edinburgh Festival Society and presented there on August 26, 1954, narrated by actor Robert Donat.

I do hope the new musical has not left out "Bustopher Jones."
Eugenia M. Reid
Highland Park, New Jersey
Fear not. It's in. Ed.

Killer hurricanes

Dear Sir: A couple of comments on A. B. C. Whipple's interesting article are in order: Galileo was not tortured by the Inquisition. And the description of Torricelli's barometer is erroneous. Had he removed his finger from one end of an open tube of mercury, the element would have fallen to the level of the basin. Actually, he sealed one end of the tube, filled and stoppered it, then inverted it in the basin of mercury and removed the stopper.
W. D. Johnston jr.
Pittsburgh
Mr. Johnston is right on both counts. Ed.

Pleasure piers

Dear Sir: Wesley Marx neglected to give equal time to the flora which also use pier pilings as their habitat. Although the various algae which grow upon pilings may not expedite the pier's demise as do their zoological counterparts, their presence should not be overlooked. On a recent collecting trip down the sandy mid-Atlantic coast these piers provided a most reliable substrate from which to gather *bangia*, the algae for which we were searching. This function is doubtless pallid to a public hooked on 40-foot equestrian free-falls, but to the members

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Now, to celebrate the 150th anniversary of author Louisa May Alcott's birth, Tasha Tudor has created her very first works in porcelain. A collection of limited edition "Little Women" sculptures that are sure to be of exceptional interest to collectors.

"Amy" portraying Louisa May Alcott's charming, blue-eyed beauty, inaugurates the collection. Crafted in fine, hand-painted porcelain, it is a thoroughly delightful work of art. And it will be issued at the very modest price of just $75—which may itself be paid in convenient monthly installments.

The figure that Tasha Tudor has designed is so vivid, so alive, it's as if "Amy" had invited you into the pages of "Little Women" to come pay a special visit. There she sits with bent head and dreamy eyes fixed on the sketchpad in her lap. From her golden curls cascading down her shoulders, to the ruffled pinafore she wears as an artist's smock—she's the very vision of loveliness. A captivating and compelling sculpture as charming and full of grace as Louisa May Alcott's young artist.

To ensure that every small detail of Tasha Tudor's art—every nuance of expression—is faithfully captured, each imported sculpture will be individually crafted by master porcelain artisans. Each sculpture will be hand-cast ... hand-assembled ... and meticulously hand-painted with uncompromising care.

In the tradition of classic works in fine porcelain, "Amy" will be issued in a single limited edition, reserved exclusively for those who order from the collection by November 29, 1982—the 150th anniversary of Louisa May Alcott's birth. When all valid orders from these individuals have been filled, the edition will be permanently closed.

"Amy" will bring her own personality and charm to your home and any room in which you choose to display her. And in time to come, this engaging work of art is likely to become a treasured family heirloom, lovingly passed on from mother to daughter.

To acquire your own hand-painted fine porcelain sculpture of "Amy" by Tasha Tudor, it is important to act promptly. Please be sure to mail the accompanying advance reservation application by November 29, 1982.

Figure shown actual size of 5¼" in height.

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Al Steinman
Kingston, Rhode Island

Crowcrow

Dear Sir: Reading about Rudolph Chelminski's pet crow brought memories of the crippled, naked little nestling that once came to live with my husband and me. He appeared, a foundling so to speak, on our doorstep. His response to our careful ministrations was instantly rewarding, and as soon as his identity could be determined my husband named him Mr. Rufous Brown, for he grew into a magnificent brown thrasher. His crippled leg healed rapidly but it was several years before his drooping wing became strong. Under our close supervision, to protect him from predators, Rufous exercised regularly and reveled ecstatically in his ritualistic ablutions and sunbathing.

He was a bird of rare dignity, from the majestic curve of his long, thin beak to his lengthy, fan-shaped tail, with a brown spotted breast and beautiful golden brocadelike figures on his rufous wings and back. The varied and ineffable sweetness of his song endeared him to all.

Eventually, able to care for himself, he flew away—but soon returned to show off the mate he had acquired, parading her back and forth before us.
Florence Lindsay
Winter Haven, Florida

Dear Sir: Although I enjoyed your article about Crowcrow, I disagree with the author on one point—that the crow will always be with us. They and magpies can be hunted in California and are being slaughtered at such a rapid rate that steps must be taken to save them. What a horror, to see this intelligent, useful bird being used for target practice by those who want to kill something.
Jean Gaudreau
Yuba City, California

Dear Sir: My son forgot to write about the times that Freddie Boyd—that Yankee neighbor whose spectacles the bird once stole—had to get out of bed early, roused by peremptory pecks on his windowpane, and make Crowcrow a peanut butter sandwich for his breakfast.
Pauline Chelminski
Wilton, Connecticut

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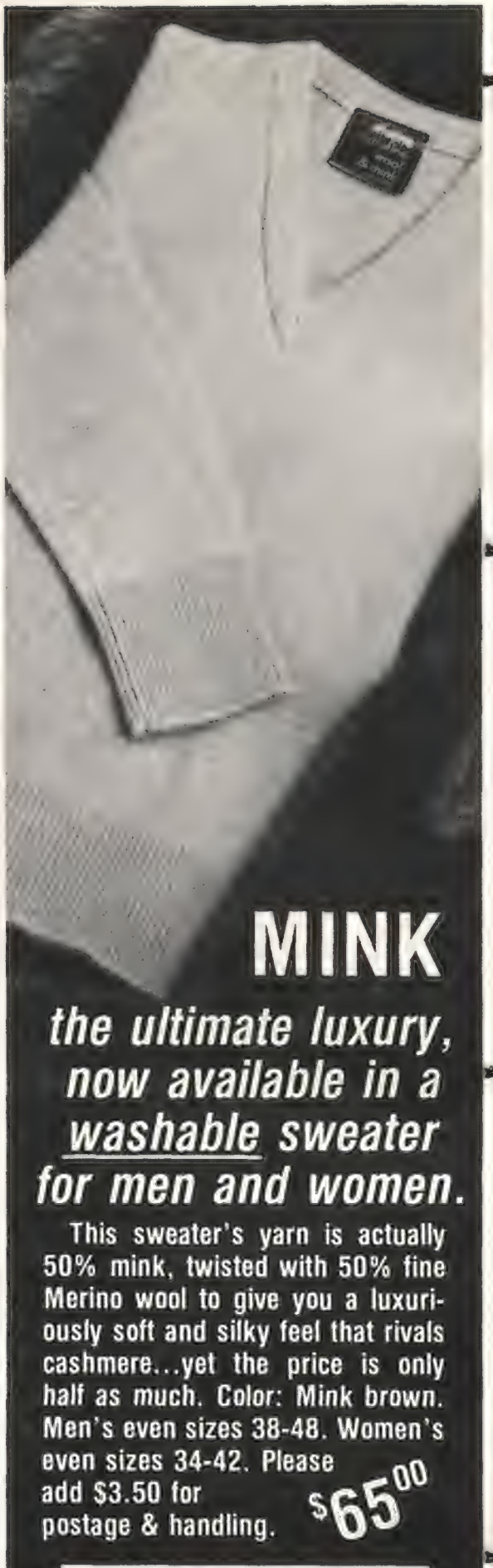

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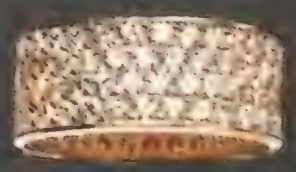

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Around the Mall and beyond

The end of summer produced a determined drought in Washington, so I wasn't too surprised, one warm and sunny morning, to find that the Office of Horticulture, run by my old friend Jim Buckler, had opened up with its heavy artillery. This weapon, herein pictured, is a huge fire hose leading to a rotating spout. Between it and a few other sprinkling devices like perforated hoses, Buckler's big responsibility, the Victorian Garden, was practically a swamp with compensatory man-made rain.

The grass was as damp and green as Ireland's; the late bloomers in the flower beds gleamed with renewed vigor; the winding paths of crushed red shale contained fresh puddles.

The giant watering hose so largely responsible for all this delicious dampness, suggested by Jack Monday, assistant director of Horticulture, is four inches in diameter. When it's going you can jump on it and it feels like an iron pipe. Its rotating spout blasts water 85 feet, according to Ken Hawkins, grounds foreman.

It could cover half the Victorian Garden at a time, but it would also soak down incidental strollers—tourists, curators, young lovers, squirrels, museum directors, Henry the Mockingbird and Secretary Ripley himself, who likes to amble through.

In an effort to understand how this magazine reaches me—and nearly two million others—every month, I accepted an invitation to explore our subscription process. Like most other magazine subscribers, SMITHSONIAN's are taken care of by a specialized computer firm that has the best and the brightest modern equipment. Ours is Neodata, and the fact that it resides in Boulder, Colorado, spectacularly placed in the shadow of the Flatiron Mountains, had a certain amount to do with my desire to go there. I pictured basking in the Rocky Mountain sun and lolling late abed. I found, instead, that I was in for a dose of explanations—a sudden education at the hands of some very dedicated and certainly patient teachers.

First fact, gleaned at dinner after arrival: Neodata processes the subscriptions

Giant spout wets down the Victorian Garden.

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of some 116 publications, or, putting it another way, Neodata takes care of more than 40 million subscribers—and yet does the job with personalized attention.

Visiting the plant the next morning, I realized that it has to be huge to accomplish this task. I suppose the University of Colorado is Boulder's largest business —its students, in shorts and hiking boots, ride their bicycles ubiquitously—but Neodata must be one of the city's biggest commercial enterprises. Its buildings are scattered along various sunny streets, and I guess I got to all of them.

First the Mail Room. When you write to this magazine about your subscription, your letter arrives in one of five daily deliveries. If you've done a routine chore like extending your subscription or paying a bill (both worthy tasks), you made use of an envelope that has special marks on it—small horizontal bars or a series of squares. These serve as a code to help the sorters stack your paid bill with all the others, and so forth. But if you write on your own hook to tell us about your subscription or to suggest (as some people do) that the Institution might be interested in Great-Grandfather's Civil War diary, your envelope is, of course, uncoded. It's called "white mail" and must be handled individually, letter by letter.

Envelopes coded for payments are rapidly relieved of their order forms and checks. Speed suffers when a check is stapled to a statement. One sorter sprained a wrist yanking the staple out.

Checks are validated, separated from the order forms or statements, and then the batches are counted by weight, a marvelously accurate method, I was assured.

Now take one of these batches—new orders, let us say. These go to a scanner, a pretty sophisticated piece of electronics that lurks behind a door with a combination lock and enjoys climate control.

The scanner adds our new subscribers to a magnetic tape. This in turn, is fed into a central processing unit which then has all newcomers firmly in its grasp—names, addresses, zip codes. The scanner can handle 17,000 names an hour, but, I was told, "that's really wishful thinking," because there are always small situations that require the intervention of human beings. It's nice to know we are sometimes needed. For example, a subscriber who scribbles something on the face of a form is apt to obliterate some of the com-

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Few nativity scenes have been as compellingly captured as Boehm's "Spirit of Bethlehem Collection." Every year through 1983, new pieces are added. This Christmas, the majesty of the Three Kings graces this glorious setting. Each figure is crafted of pure, white bisque porcelain in Neapolitan style. This inspired collection is available in three-piece sets at the Fine Jewelers Guild stores listed below. King set, $650. Nativity set, $475. Neapolitan angel set, $495. Shepherd and sheep set, $475.

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"EYE OF THE SWAN"

During the holidays, the kitchen is the heart of our Sonoma Valley home. Here, the marriage of wine and food fills the air with wonderful aromas and memories of vintages past.

This year, I have asked my mother, Sylvia, and my wife, Vicki to share some of their holiday recipes with our friends.

If you will drop me a note at the address below, I will be happy to send these to you.

From my family to your family . . . Buon Natale!

Sam J. Sebastiani

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"A Family Winery in the Sonoma Valley"

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PO BOX AA, SONOMA, CA 95476

puter symbols. So human attendants, alerted by the machine, are able to magnify the form in doubt on viewing consoles and so reveal the correct symbols.

Customer Service: here is a great computer device called the "Main File Look-Up." When you send in a query about your subscription, your name can be tapped out on this console and your subscription record simply flashes on the screen—there you are in green computer letters, fortunately without Pac-Man to gulp you down. Here a mistake in an address becomes apparent. A gift subscription may be errant because a subscriber misspelled a street name or got a zip code wrong; the screen reveals it, and the correction is made. A computer does exactly what it is told to do, and if wrong information gets past its programmed safeguards, it finds the wrong solution.

I saw the label printer at work. All those names and addresses are fed into it electronically, and it prints them on a narrow roll of paper—as wide as the label on your magazine. A delicate, barely discernible spray of ink does the job at a rate of speed that can reach 180,000 names an hour. The printer doesn't actually produce that many in that time because it has to change rolls of paper when the first is spent and the next is ready. As an old newspaperman, I watched this with some fascination, for the shift was a miniature "flying paste," similar to that of the giant rotary presses I worked with on three daily papers. The new roll shifted into position and began to pick up speed, then the paster flicked like a snake's tongue and—with a bang!—the new roll became united with the old.

There was a lesson for us all in the label printer. The press was working on the August issue of a magazine, yet this was June. And it became very clear why, when we change address and notify our favorite magazine, we are told that we will have to wait a bit before the magazine comes to the new address.

Finally I saw the central processing unit, the computer that has us all on tape, that supplies the names for those thousands of labels. At Neodata, it's a series of cabinets in a large room—no blinking lights, no robot arms, no searching antennae. Yet such a package of power exists here that the system is kept cool with glycol.

In some cabinets are disks that hold the names of millions of subscribers. An

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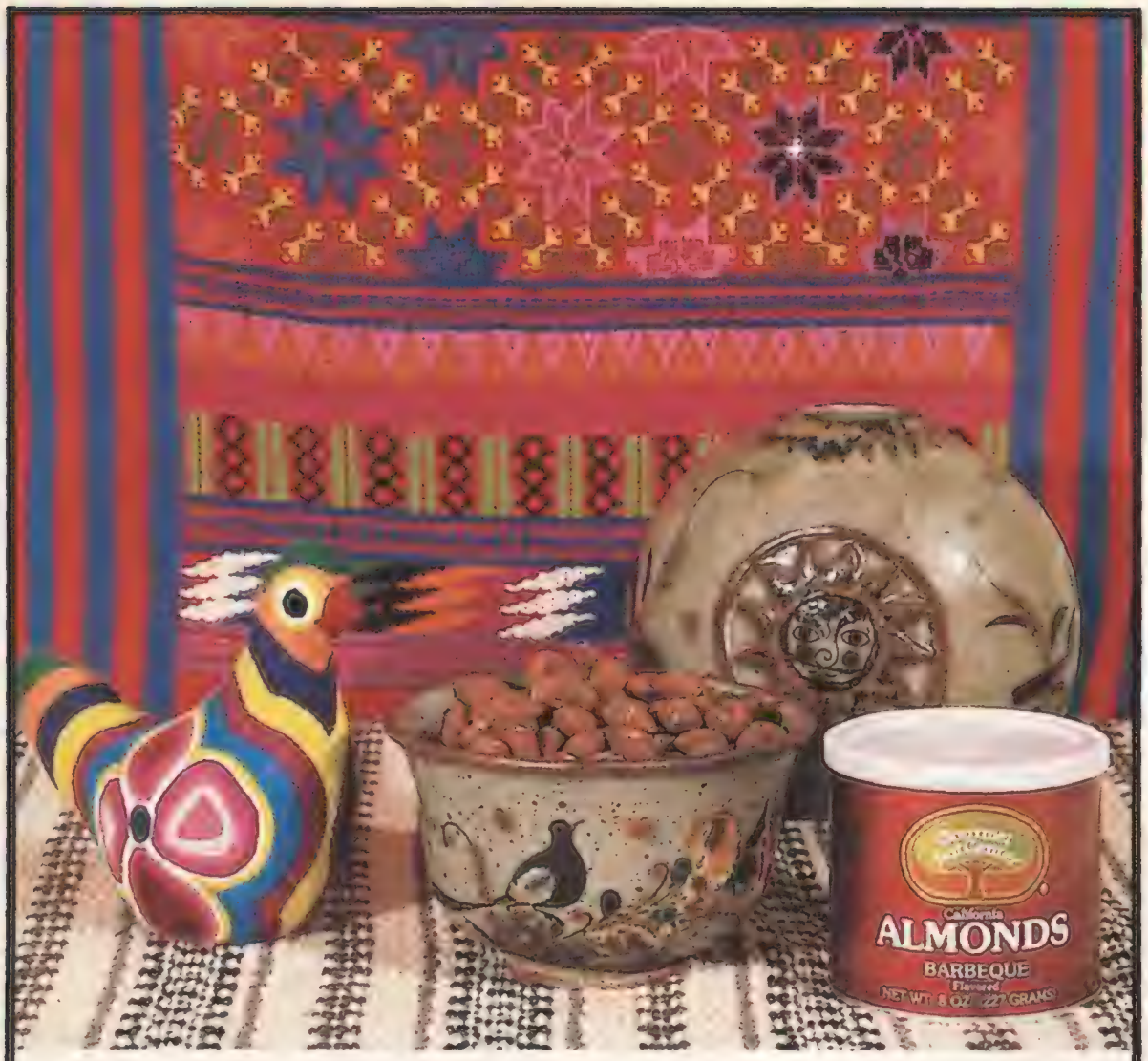

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Name: _____

Address: _____

City, State & Zip: _____

electronic head moves back and forth above each spinning disk without touching it. It's searching for an address, finding it and transmitting it. The disk is spinning so fast that if a microscopic particle of smoke got between it and the head, it would gouge the disk surface.

It's not just your magazine label that erupts from Neodata. Other tapes produce membership cards, invoices, renewal notices. I went to the warehouse where some 450,000,000 (that's nearly half a billion) pieces of paper—various forms, letters and envelopes—are stored for mailing. SMITHSONIAN's shelves rise four levels and extend the length of a New York City block, 20 feet wide. On that day they held 21,315,110 pieces of mailing material. You have to wear a hard hat when you visit so that you won't get hurt if a batch of renewal reminders falls on you.

I was fairly numbed by newly gained knowledge by the time that afternoon had neared the end. I blinked at the mountain sun when I was finally let out. And around me were a number of Neodata people on a coffee break, sitting in that crystal-clear sunlight under the Front Range, which supervises Boulder.

And as I left, I realized a truism that is establishing itself more firmly with me upon every passing birthday: as I get older, I must accept the fact that certain things in life will always elude me. I doubt if I'll ever master hang gliding, for example. And I'm afraid I'll never handle computerese. On the bulletin board in the central processing unit room was a message from one human being to another. I quote it here, exactly: "When bringing up Roscoe, reply 'u' to message * 1 EC507D E 150. Spool 1, Roscoe Roscoe 1 EC507D Reply 'U' use or 'M'—UNLOAD*."

Pretty weird. But on the other side of the coin was an acquaintanceship with some extremely attractive people—capable men and women who had that aura of doing a hard job well and faithfully. Also with humor. A favorite joke at Boulder comes from a cartoon that someone pasted on a Neodata bulletin board. A computer scientist is angrily addressing his big, placid processor: "If you don't behave, I'll replace you with 700 people!"

It's funny, and it also reminds us that the devices exist only to speed the process of getting us subscribers sorted out and happy with our magazine.

Edwards Park

"Why give a ho-hum gift? Knock 'em out with treasures from the far corners of the world!"

Ancient Chinese porcelains from the Ch'ing Dynasty, dating from 1644. One-of-a-kind pendants hand-painted in assorted colors, silver-plated brass rims. About 1⅛-1⅞", no two alike—let us choose. Plus 30" burgundy and green silk cords, authenticity certificate, in a brocade case.
3681 Ch'ing Pendant $15.00

Rare Venetian glass from Murano, Italy, where master glassmakers create each jewel-bright flacon by hand for us alone. "Mille fiore" (1000 flowers) and filigree patterns combined, the ruby red of the stopper made with real gold. 5½" tall, each unique, a museum-quality original. Gift-boxed.
7976 Murano Flacon $19.98

Pewter and brass duck box, a symbol of good luck in China, handsome objet d'art for the collector. Beautiful contrast of brass and pewter, almost five pounds, 8" from beak to tail. From China.
7789 Pewter Duck Box $29.98

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"Kiki" will steal your heart— she's so lovingly detailed. Pink dress and cap of fine wool knit, white wool tights, hand-painted face, arms, legs of skin-touch vinyl. Soft fabric body, brown hair, blue eyes. Ours alone from Italy, about 16" tall, gift-boxed.
7543 "Kiki" Doll $29.98

Our exclusive personalized carryalls, black cotton canvas, genuine tan leather. Initials in 22K Gold. 15x12x6" tote has long leather handles, 14½x10" portfolio tucks inside or goes alone.
2480 Portfolio $10.98 2479 Tote $15.98
2481 Both. 1 Set $24.98

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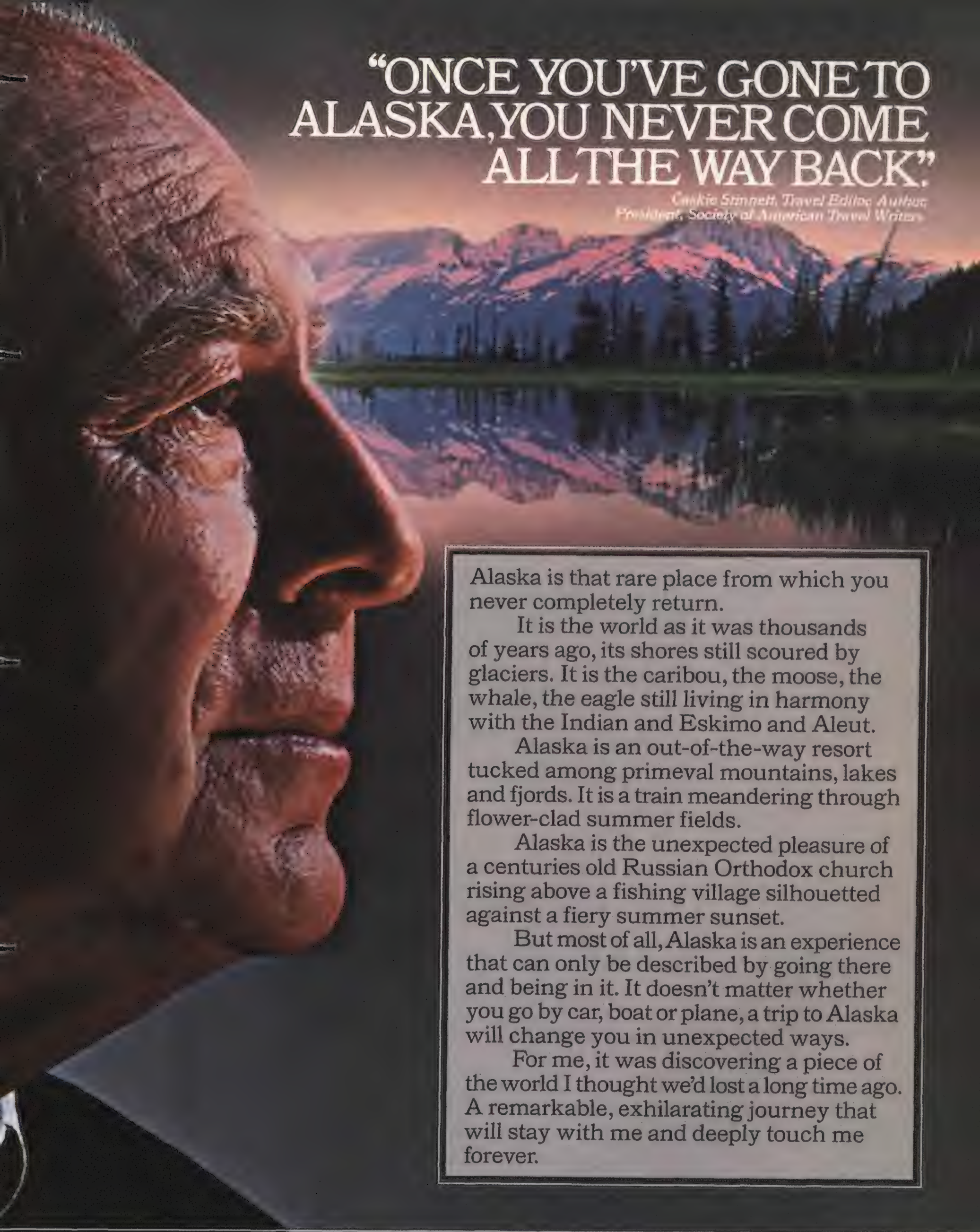

"ONCE YOU'VE GONE TO ALASKA, YOU NEVER COME ALL THE WAY BACK."

Cookie Stinnett, Travel Editor, Author,
President, Society of American Travel Writers

Alaska is that rare place from which you never completely return.

It is the world as it was thousands of years ago, its shores still scoured by glaciers. It is the caribou, the moose, the whale, the eagle still living in harmony with the Indian and Eskimo and Aleut.

Alaska is an out-of-the-way resort tucked among primeval mountains, lakes and fjords. It is a train meandering through flower-clad summer fields.

Alaska is the unexpected pleasure of a centuries old Russian Orthodox church rising above a fishing village silhouetted against a fiery summer sunset.

But most of all, Alaska is an experience that can only be described by going there and being in it. It doesn't matter whether you go by car, boat or plane, a trip to Alaska will change you in unexpected ways.

For me, it was discovering a piece of the world I thought we'd lost a long time ago. A remarkable, exhilarating journey that will stay with me and deeply touch me forever.

S K A

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Phenomena, comment and notes

With serious humor buffs, happiness is a chance to trade quips, theories and pick a peck of Peter's Principles. For once, Ralph Nader agrees

A funny thing happened on the way to the Shoreham: as my cab careened out Connecticut Avenue toward the venerable hotel in Washington, D.C., I caught the driver in three-quarter profile when he turned to ask, "Main entrance?"—and saw before me a ringer for Zero Mostel. Good omen.

Coupled with the fact that the Shoreham has been the scene of many a Presidential inaugural ball and is therefore no stranger to funny goings-on, all auguries seemed in great shape for the opening session of the Third International Conference on Humor (sponsored by the Workshop Library on World Humour, the American Humor Studies Association and Montgomery College), which had moved in on the heels of the American Psychological Association's annual meeting. Of the nearly 400 Humor registrants, a surprising number turned out to be leftover psychologists.

Leftover or not, they joined professionals ranging from anthropologists to stand-up comics during the next three days to expound on such subjects as "Self-Training in Humor for Mad, Sad, and Glad Humanoids" and "A Psychological Analysis of Comedians and Clowns"—who, I learned, discover early in life that they can make people laugh; want to convince others that neither they nor the world in general are as bad as they seem; see their bodies as reduced, lowly, depreciated, and themselves as worthless people, no matter how successful they become; and as children received the message, usually from hypercritical mothers, to grow up *fast*.

But these are not the only courageous folks who consider humor a fit subject for exploration. (Students of humor, it developed, are often thought to be a trifle peculiar.) Antony Chapman, looking, in his blue pinstriped shirt, as though he had just stepped over from Her Majesty's Embassy, recalled the first international humor conference, sponsored by the British Psychological Society and held at the University of Wales in 1976. "In the 1960s and early '70s, there was growing interest in humor among social scientists in general. We received permission to convene at the university, but had to promise that we would in no way associate the university with our meeting." (He does not seek publicity, at least in Great Britain, for the serious study of humor

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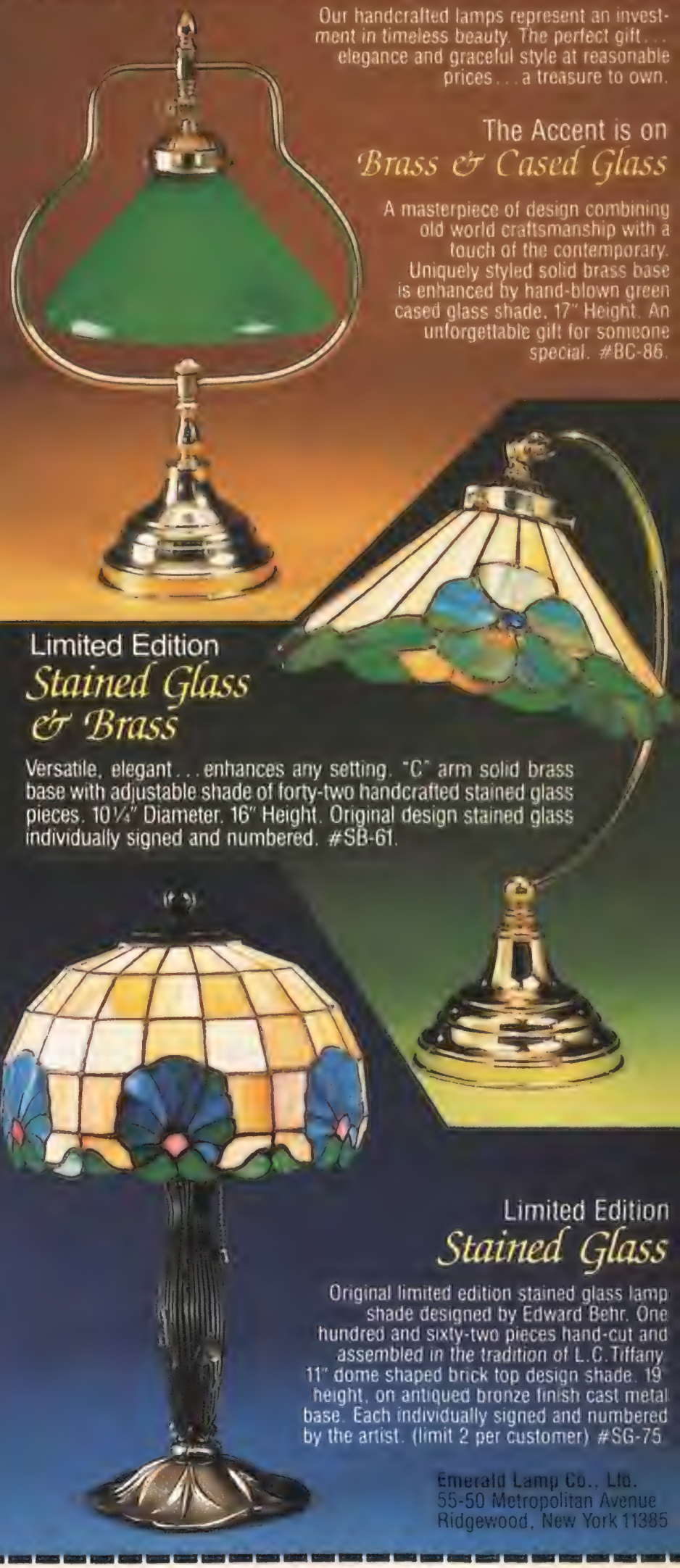
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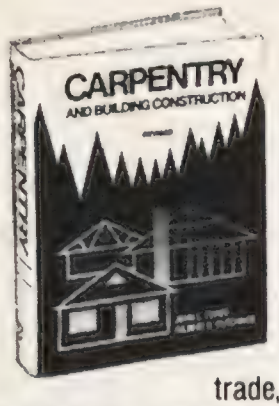

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because the press "finds it teaseworthy.")

And so it was with a damn-the-press, full-speed-ahead spirit that linguists, historians, professors of literature and of communications, classroom teachers, medical doctors and nurses, journalists, therapists, sociologists, lawyers, actors, mimes, comedy writers, professional public speakers and at least one clergyman came together at the Shoreham under the banner of humor, to present in traditional academic style some 180 papers on how to create it, use it, dissect it—and why to celebrate it. And to do it they came from England, Ireland, Wales, France, Israel, Canada, Germany, India, Korea, Japan, Australia and probably a couple of countries I have missed, as well as the United States.

First on the agenda was political humor, perhaps because there is so much of it dispensed, accidentally and otherwise, in the capital city. Speechifying is big business here, and Cicero would be pleased to learn that his instructions for orators have been taken to heart. He made the study of humor mandatory: "Joke with good reason, not to appear jesters, but to obtain some advantage." We were told by a Bryn Mawr professor of the anti-Republican wag who explained, a few years back, the root of then-President Gerald Ford's fierce dislike for New York—so intense that he refused to bail it out of financial difficulties: "He was visiting the city during a blackout and got stranded for six hours on an escalator." And by a professor from Goucher College of the late Senator Everett Dirksen, who chided his fence-sitting colleagues: "He who hesitates is torn between vice and versa."

On the podium at the opening-night banquet was a red-haired, freckle-faced, central-casting Irishman named Desmond MacHale. Besides teaching mathematics at University College, Cork, he writes jokebooks ("Not under my own name, of course!") and reads humor. If ever there were a one-man campaign under way to improve the lot of the ethnic joke, MacHale is it. Many present mourned the growing list of untouchable subjects for humor—ethnic groups, international relations, the feminist movement. They regret that the therapeutic effect of laughter is being withheld from areas in which they feel it is sorely needed. MacHale has not received the quarantine notices, particularly for his compatriots:

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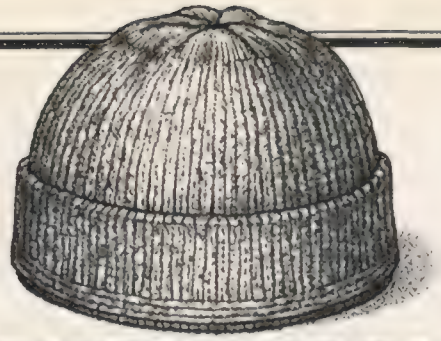

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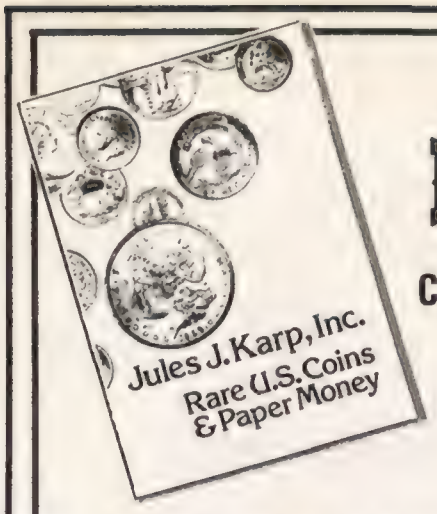

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"My favorite graffiti—it must be Irish—is: 'Reality is an illusion created by a shortage of alcohol.' "

"In Ireland we have a dial-a-prayer phone service for atheists. They dial and the number rings and rings and rings...."

"Today no Irish mother will have more than three children because she's heard that one out of every four kids born is Chinese."

About the last person I expected to see at the Friday dinner was consumer activist Ralph Nader—a reasonable nonexpectation. But suddenly, post-fruit cup, there he was, sliding onto an empty chair at my table in the cavernous ballroom.

We talked. He is genuinely interested in the functions of humor—communication, therapy, conviviality—and believes it to be a lot more important than many comedians make us think it is. "In humor there is truth; in truth there is humor," quoth he across the baked chicken. "The more we learn about it, the closer we can come to the essence of happiness. The more humor that people create themselves, the more they benefit from it, rather than simply being bystanders and letting it reverberate off them from some comedian on the stage.

"We need a decentralization of humor, more self-generated humor like that of old folk cultures which have a rich oral tradition—proverbs and such—that creates much happiness in people's lives. In industrialized societies we rely almost completely on canned humor—we have so commercialized humor that it becomes a function of credentials: you are a 'comedian' or a 'humor writer.' "

With that, he volunteered his own example of humor as a communication device. "Question: How can the U.S. business community defeat the Japanese business community? Answer: Have an executive-exchange program. If the head of GM became the head of Toyota, that's the end of competition from Toyota!" Then, with a twinkle, "We need affirmative action in the area of humor. We need to take humor more seriously and laugh at it more frequently."

It was my turn. "Question to Unsafe-at-any-speed Nader at a humor meeting: 'Have you heard any jokes that were unsafe?' Answer: 'No, but some were told too fast.' " Well, at least it's homemade.

As the weekend rolled by, it was difficult to choose between "The Effect of Mirthful Laughter on Blood Pressure"

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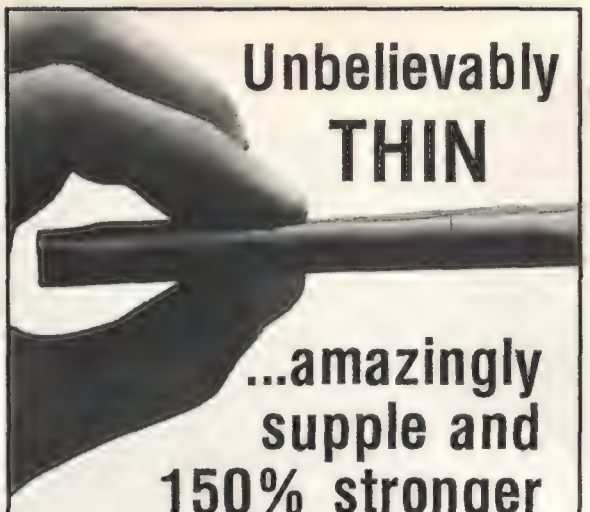
I lucked out with diminutive, feisty Bakul Tripathi, a journalist, broadcaster and communications professor from India, who had been in motion across the United States since mid-April gathering material for a whimsical travelogue: "We have a fascination for America; everybody is wide-eyed as to what is happening. I got the idea from Mark Twain, you see—I'm a not-so-innocent abroad." He was scheduled to speak on "Humorous Communication in Asian Indian Folk Forms" as it evolved from medieval India but wanted to talk about what he had observed in our hinterlands. "American laughter is more unrestrained than ours —the sky's the limit for variety of subjects —you have no taboos. In India we have taboos: the 'respected ones'—a sectarian god, for example—we have hundreds of sects—we do not make jokes about because we pride ourselves on being tolerant. Indians are suspicious about humor, more cautious than you; humor is not accepted as absolutely *in*. But we laugh at authority—we are impatient with it—and at our own clumsiness."

What "impressed and confused" Tripathi the most were the pervasive American cheerfulness and goodwill. "I expected more stress—you are vulnerable, on the brink; we are not. No one will press a button and—poof!—my village will not be there, but New York. . . ? Or is there tenseness I did not perceive?"

Not all sessions were filled with fun and games. One entitled "The Socially Constructive Uses of Humor" included presentations by a Veterans Administration psychologist who uses humor therapy in helping Vietnam veterans rise above stress (he cautioned us not to expect to learn much about a sense of humor from



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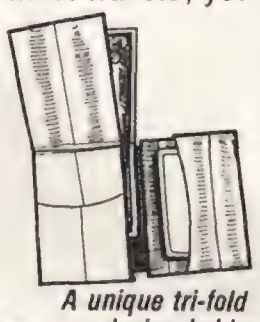

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A point made extremely well in the photograph above by Mr. Earvin Johnson, a basketball player of some note.

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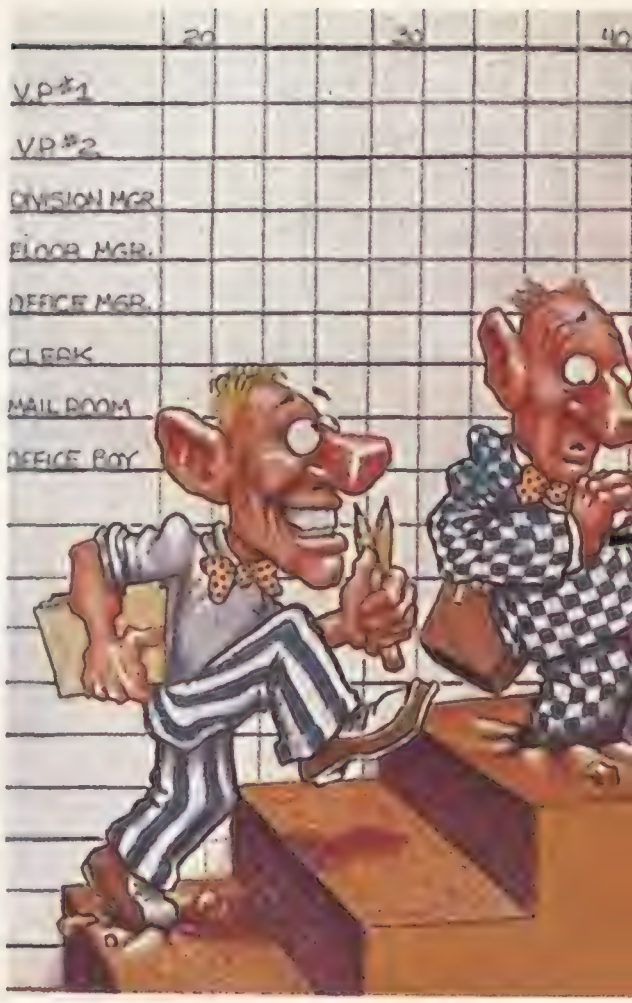
psychologists because white rats and mice and pigeons don't have senses of humor), and by a prison therapist who encourages inmates to develop a "comic vision" in order to endure and to address anxiety ("Just as you make ends meet, someone moves the ends"), aggression, depression and stress. He sees humor not as a panacea but a useful tool in his work.

Hippocrates would rate Dr. Douglas Lindsey, a trauma surgeon from the University of Arizona, A+. The Father of Medicine believed that a "physician should have a certain ready wit, as dourness is repulsive both to well and ill." Lindsey, a Barry Goldwater look-alike ("It helps me enormously at restaurants—'Right this way, Senator' "), is not only a linguist and student of humor, but surgical editor of the *Journal of Irreproducible Results*. His formal talk dealt with difficulties that jokes have in passing across linguistic borders: "like other currency," they are often "discounted heavily . . . some to the point of becoming worthless." But over a cup of coffee he spoke of a dilemma not foreseen by Hippocrates. "Emergency-room humor seems blunt, ribald and sometimes disgustingly crude to outsiders, but it takes the edge off grim reality for us so that we can stand the stress—and do our best for the patient. Of course there is etiquette—we never make fun of a patient *to* a patient. But a man once complained in writing to the state medical society that during his stay in the emergency room he heard me *laugh* on several occasions. Well, now, we enjoy our work—not the individual's pain—but we enjoy *ourselves*. I guess one is not supposed to laugh at funerals—or in the emergency room."

Like a theatrical production, which in a way it was, the gathering at the Shoreham had its stars. In one of them, Laurence J. Peter, originator of the now-famous Peter Principle—"In a hierarchy, individuals tend to rise to their levels of incompetence"—most of the conference currents came together. Except for the analysis of what it is that makes us laugh. "Theories of humor interest me not one little bit," declared the tall, bearded, gangly Peter who, if he chose to wear a three-piece suit, could pass for a Viennese psychiatrist. He came across instead as



Onward and upward in workaday hierarchy, a splendidly ept office boy

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the slightly rumpled educator, philosopher, satirist and scourge of mediocrity and pretentiousness that he is. "Trying to define and analyze humor is a waste of time. Somebody tickling you with a feather will make you laugh, but it's not funny. Humor is in situations, personality, incongruity. Put it all together and you get W. C. Fields—a consummate comedian; everything he did was funny."

Peter sees humor as a tool in problem solving, communication, teaching and psychotherapy. He was applying it in those areas long before moving to the University of Southern California from Canada 16 years ago. "Now I'm studying international humor as a force for peace —finding what different people in different countries think is funny. How about my Peace Principle?: 'I'd rather have a shaky peace than a steady war.' "

Believing that the object of satire is "to tell the truth in a funny way," Peter continues to grind out Principles worthy of his first. He can get into trouble. "All humor is offensive to somebody; the only foolproof way is not to use any at all—most TV humor consists of comedians making fun of each other. It's incestuous; they're dealing with form, not substance." At a meeting of psychotherapists not long ago, the women booed when he offered his Feminine Principle: "Most hierarchies were established by men who now monopolize the upper levels, thus depriving women of their rightful share of opportunities to achieve their own levels of incompetence."

"Those who booed me didn't hear the joke. It's a profeminist statement."

Perhaps to make amends, Peter developed a Sexist Principle: "No person should be discriminated against because of the shape of her skin." Yes, there is a Marriage Principle: "All marriages are happy. It's living together afterwards that can be troublesome." And a Financial Principle: "Starting from scratch isn't so bad. It's starting without it that's tough." Behold Peter's Prophet: "The meek shall inherit the Earth but not the oil rights."

"You must agree," he grinned, "that laughter may not cure, but at the very least it reduces pain, diffuses trouble, has no bad side effects—and it's free!"

Nancy Seaman

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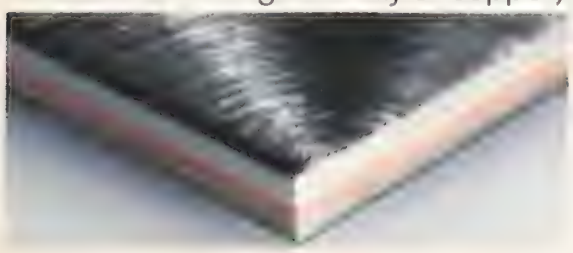

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Points of origin

In history and myth, hairstyles have proved a good guide to people's faith and politics, if not their sex

The debate over how to wear hair—for both men and women—has swirled throughout recorded time. Should men's be short or long? Should women's be bound up in braids, hidden under a wimple, or flow in provocative tresses? Should men be bearded or clean-shaven?

As soon as any one generation gets a handle on these questions, its rebels and gainsayers magically appear, armed with scissors or curling irons.

The English Civil War (1642-48) is a case in point, and is clearly the watershed event in the history of modern hair fashion. As every schoolboy knows, this bit of antique carnage pitted the Royalist forces under the elaborately coiffed King Charles I against the Parliamentary forces under Oliver Cromwell. The followers of Cromwell, largely Puritan in spirit, had their heads close-cropped, an act of defiance toward the curls and ringlets of the king's men. In the end, the rebellious Roundheads—as they were derisively called—conquered the dandified longhairs. And with that victory, the Roundheads left a palpable legacy: the majority of 20th-century men have opted for short hairstyles. Perhaps if the Royalists had won the war, King Charles might have kept his head, and my own locks might now be dangling down to the level of the legal pad in front of me as I write this account.

But if emphasizing the mane with elaborate curls and wigs is an act of self-satisfaction and vanity, and cropping it is a symbol of reaction and intolerance, what can be said of shaving the head? Beginning about the eighth century, Christians adopted a primitive custom of shearing the hair of laymen about to be consecrated into the clerical state. This rite was called the "tonsure" (from the Latin *tondere*, "to shear") and gradually evolved into three forms. In the Greek or Eastern tonsure, also called the "tonsure of St. Paul," the whole head was shaved or very closely cropped. Farther west, the Roman or "crown" tonsure, also called the "tonsure of St. Peter," left its adherents with just a fringe or circle of hair about a bald center, a custom that is still followed by some monastic orders to this day.

Both tonsures were a sign of humility and dedication to the service of the church. For the ancient Celtic churchmen an even more radical tonsure was chosen. It consisted of shaving the top of the head in front of a line drawn from ear to ear. The hair in back was allowed to grow long, and must have given those men quite a crazed appearance.

What stands behind the custom of the tonsure is a body of lore that taught that a person's spirit was embodied in his hair. The survivals of such a belief are visible in the Scottish children's sport called Tappie-tousie, described by an early folklorist thus: "One, taking hold of another by the forelock of his hair, says to him, 'Tappie, tappie tousie, will ye be my man?' If the other answers in the affirmative, the first says, 'Come to me then, come to me then,' giving him a

This caricatured coiffure had to be held aloft by an elegant pitchfork.

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smart pull towards him by the lock which he holds in his hand. If the one who is asked answers in the negative, the other gives him a push backward, saying, 'Gae fra me then, gae fra me then.' "

The game contains a dim memory of the ancient custom of taking hold of a bondsman's hair to receive him into servitude, a sort of secular parallel to the religious tonsure. Further, because it was such a humiliation to have someone seize you by the hair, it being formerly a symbol of servitude, the medieval Teutonic laws imposed stiff fines for this particular breach of the peace. On its face, this crime seems trivial to modern sensibilities, but even a cursory look at the weight of penitence and servitude behind the custom quickly shows why the fine in Saxony was 120 shillings for pulling someone's hair.

The belief that a person's spirit was embodied in the hair gave rise to countless folk customs. Among them, that one should bury his hair to prevent it from falling into the possession of his enemies, or that a dead man's hair could be used to make a well man ill. If mice gathered a person's hair clippings and used them to line their nests, he would either get headaches or become an idiot. If a bird, especially a magpie, made a nest of an Englishman's shorn hair, that man would die. The Nandi, an East African tribe, shaved the heads of prisoners and kept the hair as insurance against escape. They would return the hair only when the captives were ransomed.

Nor are these customs restricted to the far past. The Frank C. Brown collection of North Carolina folklore, compiled up through the early 1960s, records numerous instances of human hair being used in charms, spells and superstitions. Thus, "If you carry a lock of hair of a person, you will have power or control over that person." Similarly, "If a tenpenny nail and some hair are placed under the steps, witches cannot come into the house."

With such traditions in mind, it is instructive to take another look at the Samson and Delilah episode in the Old Testament. Samson, as a folk hero, is of a piece with the Greek Hercules and the Babylonian Gilgamesh. All three are strong and hairy men who undertake adventures outside their own societies, and all of them tangle bare-handed with lions, animals as fierce and wild-maned as them-

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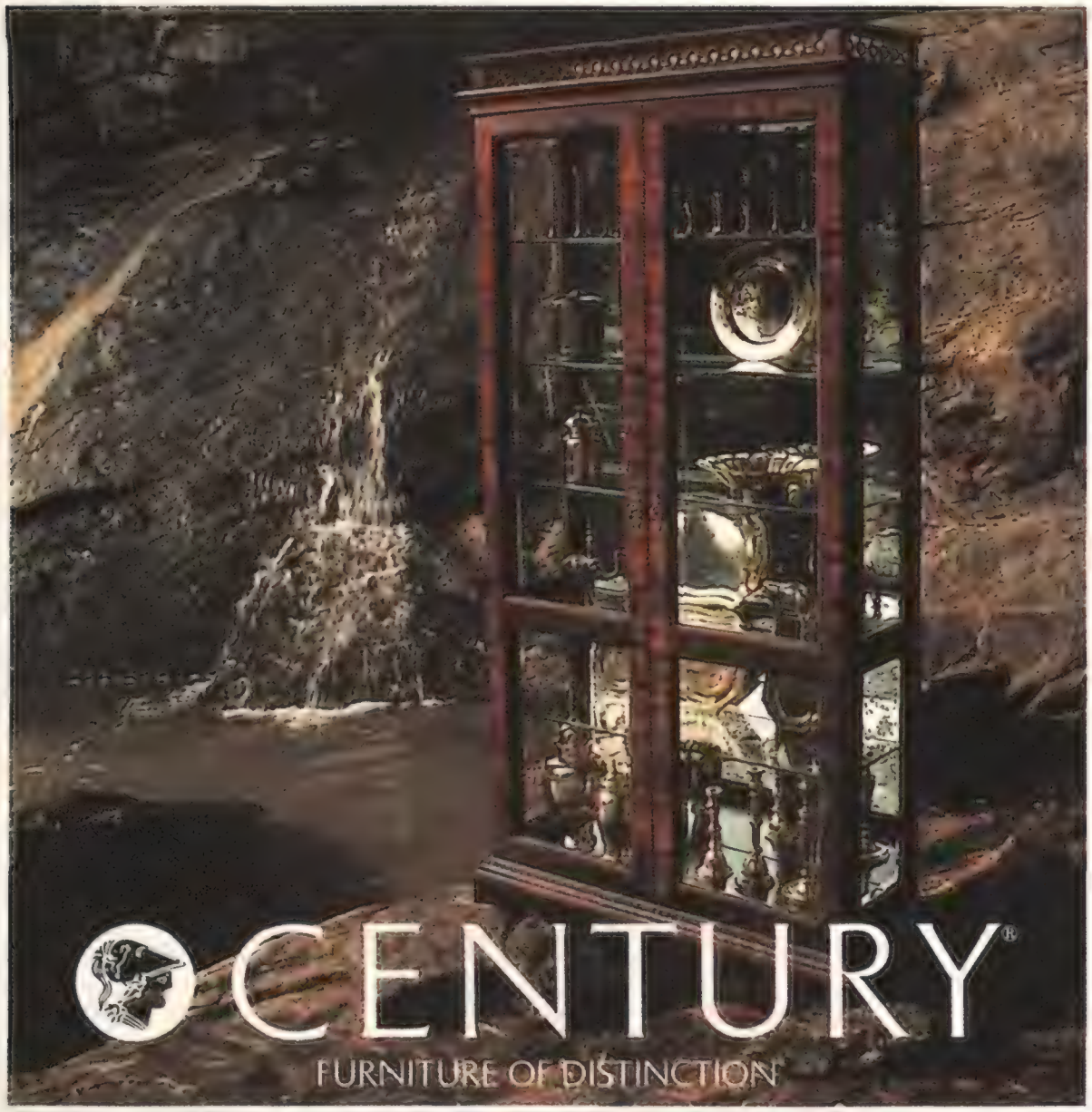

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selves. When Delilah enlisted a confederate to cut her sleeping lover's hair, she was acting in accord with a later belief that strength is bound up in the hair—a notion exhibited in ceremonies as widely separated in geography as England, France, India and Indonesia. Even the Aztecs cut the hair of accused sorcerers, to take away their strength and powers of witchcraft, before executing them.

Legends of the saints relate the tales of four people whose connection with hair is essential. A brazen beauty with long tresses, traditionally considered to be Mary Magdalene, showed her conversion to the faith by drying the Savior's feet with her locks. She is often depicted clothed solely in her hair, like some devout but red-haired Rapunzel. An Italian portrait of the 14th century shows her totally covered in hair, and in the 16th century, Titian presented her transfixed in a cloud of red hair of the shade to which his name was given. Similarly, St. Agnes, the virgin martyr, when she was stripped and driven naked into the streets of Rome by an outraged governor in about A.D. 300, simply let down her abundant hair to cover herself.

The fourth-century desert hermit, St. Onuphrius, turned his back on the world so completely that he neither shaved nor cut his hair, and wore only an apron of palm leaves. So fearsome was his hairy presence that a traveling abbot was almost driven away at the sight of this wild man, thinking him a satyr.

But by far the most horrific of all of these hair-raising tales appears in the legend of St. Wilgefortis, as told by the 19th-century scholar Sabine Baring-Gould: "The story of this Saint is almost too absurd to be given. She was the daughter of a king of Portugal; one of [several] twin sisters. Her father desired to marry her to the king of Sicily, but Wilgefortis had taken a vow of perpetual virginity. She therefore prayed, and a beard, moustache and whiskers, sprouting on her face, indisposed the prince of Sicily to accept her hand. Her father, in a rage, had her crucified."

Two further bits of folklore associated with hair are the "hair shirt" and the proverbial "hair of the dog that bit you." As for the latter, it is a commonplace of folk medicine that a cure should be derived from the agent of the disease. Thus, in

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various locations worldwide, a bit of oyster shell will cure a cut from an oyster shell, snake fat will cure snakebite, and dog liver or dog hair is applied to cure a dog bite. It follows that a small shot of schnapps the morning after should cure a hangover. This belief appeared in print as early as 1546: "I pray thee let me and my fellow have/A haire of the dog that bit us last night."

The hair shirt was seen by St. Jerome as the distinctive mark of Eastern monks. But others were not so sure about its efficacy. In the West, Cassian denounced the hair shirt as an ostentatious display of virtue. Typically, hair shirts were made from mountain-goat or camel hair and were called *cilicia* in Latin, named after the region where the cloth originated. In time, Western churchmen grew more circumspect about wearing them. Thomas à Becket was apparently a model of discretion: a hair shirt covering most of his body, concealed under his vestments, was discovered at his death.
Michael Olmert

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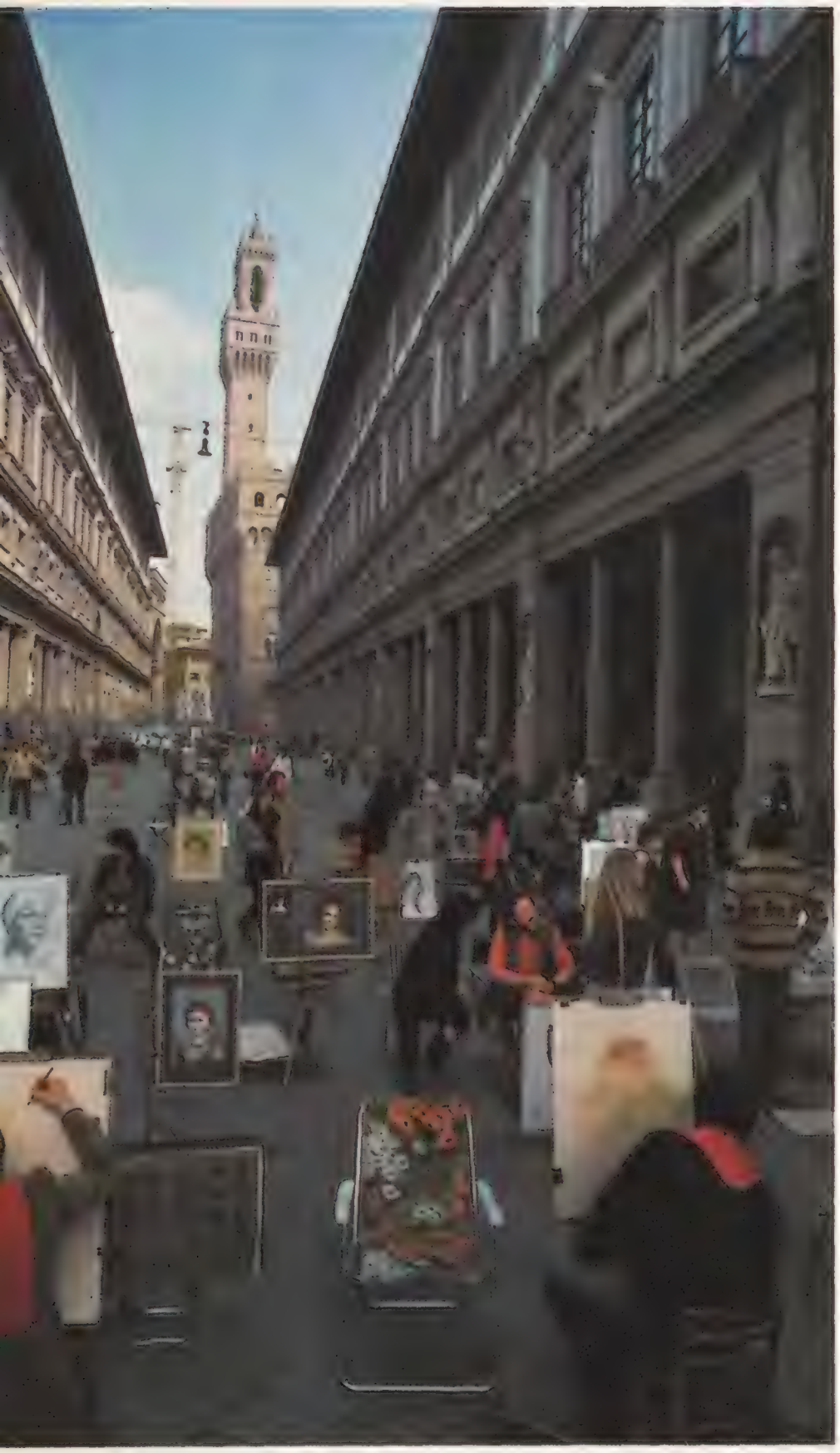
By Dora Jane Hamblin

A bright and happy 400th-birthday year for the remarkable Uffizi



Local artists, who purvey portraits to pedestrians, take up positions in Uffizi's pillared courtyard.

Enduring legacy of the art-loving Medici, this great Florentine gallery is studded with glittering array of European treasures

Florence's Uffizi Gallery is celebrating its 400th anniversary this year, and it looks astonishingly well going into its fifth century.

It houses one of the world's finest collections of Italian Renaissance paintings, a notable assortment of Flemish, Dutch, German and French masterpieces, antique sculpture, tapestries, and a superb collection of medieval and Renaissance prints, drawings and architectural plans.

Quite apart from this richness, the Uffizi is different in almost every way from almost every other gallery. It occupies only the top floor, or loggia, of a monumental building constructed for a totally utilitarian purpose. Part of it, an aerial walkway connecting the Palazzo Vecchio to the Pitti Palace more than half a mile away, is a wide and lofty passage running across the top of the Ponte Vecchio, through an old church, around the tower of a private palace, across the backs of houses and eventually into the Boboli Gardens.

The Uffizi would be splendid even without its paintings, because the three great arms of the U-shaped loggia are galleries in themselves with frescoed ceilings, glowing terra-cotta floors, great windows flooding light upon inner walls hung with almost the entire production of two centuries (1546-1737) of tapestries from Florentine factories, the most important in Italy. It attracts a million and a half visitors a year and daunts them all with its profusion. Today's visitors constitute what custodians call an "assault"—10,000 to 12,000 a day when tour buses pull up.

All this would have startled the art-loving Medici

Newly cleaned and lively with personality: Antonio Pollaiuolo's *Portrait of a Woman*, 1491.

Vasari corridor runs from top floor of Uffizi (extreme right), then proceeds across famous Ponte Vecchio.

In 16th century, Florentine artists decorated vaulted ceilings with fanciful Pompeiian-inspired frescoes.

family which ruled Florence and Tuscany for three centuries. They began the collection purely for their own enjoyment, spurred by a passion for antiquity and a lively interest in anything made by Man. They loved showing off their treasures, however, and the last of the line correctly foresaw the future by insisting that the entire collection remain intact in Florence "for the adornment of the state, the benefit of the public, and to attract the interest of foreigners."

At this remove it is difficult to say whether the Medici made Florence or Florence made the Medici. But the little commercial town, an island of republicanism and relative peace and culture, attracted the first peasant Medici off the farm in the 12th century to seek their fortunes. They brought with them a rustic love of gardens and a dislike of brute force. Gradually they prospered, as money changers, merchants and bankers, and by the 14th century they were counted rich and politically powerful.

Cosimo the Elder, born in 1389, became so impressively rich and powerful that he could—and did—behave like a monarch. His passion for building and for art exceeded even that for money, however, and Cosimo was a realist: "Fifty years will scarcely pass," he said, "before we are chased out, but the buildings will remain." He underestimated the staying power of the Medici, but the buildings *have* remained. Cosimo hired architects Brunelleschi and Michelozzo to build the church of San Lorenzo, the friary of San Marco, the Medici chapel at Santa Croce and the Medici family palace (now called the Medici-Riccardi palace). In an age when most people considered painters and sculptors mere manual laborers, Cosimo courted them as friends: men like Lorenzo Ghiberti, Donatello, Fra Angelico, Benozzo Gozzoli and Andrea del Castagno decorated the walls of his palace, his country villas, his public buildings.

Soon after Cosimo died in 1464, his grandson Lorenzo, called The Magnificent, carried on. He took under his patronage Botticelli, Verrocchio, Leonardo da Vinci, Sangallo. Toward the end of his life he opened a sculpture school in the garden of San Marco, where one 15-year-old so impressed Lorenzo that he took the lad home and treated him like a member of the family. His name was Michelangelo.

These Medici gave the family its golden age, but it was a collateral branch, the grand dukes of the next century, who created the Uffizi. Another Cosimo, who by 1560 ruled not only Florence but also her ancient rival Siena and all of Tuscany, conceived the idea of uniting under one roof all the 13 *magistrati* or admin-

Miss Hamblin, whose articles appear frequently in SMITHSONIAN, *lives just off the Via Cassia, the main road to Florence before the* Autostrada.

Cosimo the Elder, 1389-1464, began Uffizi collections.

Lorenzo the Magnificent was fount of commissions, 1449-92.

Cosimo I, 1519-74, Grand Duke of Tuscany, reassembled collections.

istrative offices of his government. As site of headquarters he chose the space between the towering 13th-century Palazzo Vecchio, the seat of Florentine government, and the Arno River. Architect Giorgio Vasari was given the task, and it was a complex one. The site was long and narrow. It was bordered by impressive palaces, and it was occupied by the Florentine mint and a beloved Romanesque church, San Pier Scheraggio, where Dante had worshipped. The earth near the riverbank was crumbly.

"I have never built anything more difficult nor more dangerous," Vasari confessed, "since its foundations are over the river, almost in the air."

The gallery part, housed in the light-struck loggias on the building's third floor, still seems "almost in the air." Down below and from outside, the U-shaped three-story building is in solid, sober Florentine style with gray stone (they call it *pietra serena* in Tuscany) and white stucco. Vasari solved the problem of the church and the mint by incorporating them into his structure, and by a stroke of genius he ran his loggia over the Arno River end of the U but left the ground floor open to provide light, air and a walkway into the courtyard of the Uffizi.

Vasari did another aerial act only five years later, in 1565, when Cosimo asked for a covered passageway reaching from the Palazzo Vecchio to the new family seat in the Pitti Palace on the other side of the river.

Still one of the most evocative reaches of the Uffizi gallery, the "Vasari corridor" was used solely as a royal walkway until 1866, when it was opened to the public. Many an elder citizen in Florence today remembers using it, especially on rainy days, to walk from one side of the city to the other, crossing the river on top of the Ponte Vecchio, walking high across houses and public buildings. The corridor is almost 15 feet wide for most of its length, and still contains a major part of the Uffizi's famous collection of artists' self-portraits.

Though first called *i magistrati*, the entire building, gallery and all, soon took on the simple name Uffizi, a variation of *uffici* or offices. The name was to stick through the centuries, long after the offices vanished.

Cosimo lived to see both corridor and offices completed, but there is no indication that he ever intended to make an art gallery. That thought came to his rather eccentric son Francesco, who in 1581-82 decided to close off one wing of the loggia floor and display within it part of the enormous store of Medici treasure. He commissioned architect Bernardo Buontalenti to decorate and organize it, and Buontalenti hired a group of Florentine artists to create the distinctive frescoes of the vaulted ceilings. These include the Uffizi's famous "grotesques," the fanciful beasts and semihumans, the twining vines and otherworldly gardens, which are still there. They were based on ancient precedents—in this case, the paintings and frescoes of Nero's house in Rome and of Pompeii.

The new gallery was not, in the beginning, primarily a picture collection. It was a mishmash of valuables, including antique Roman marble copies of Greek sculpture, Etruscan bronzes and sarcophagi, Roman sarcophagi, portrait busts, arms and armor, precious gems, books, Egyptian ivories, maps, prints, porcelain and scientific instruments such as telescopes and astrolabes. It was an eclectic, wide-ranging, intensely humanist assortment of objects which several genera-

Greek-inspired, the "Medici Venus" was stolen by Napoleon, recovered; it is most popular masterpiece.

tions of Medici had been rich enough, and curious enough, to acquire.

As the jewel of the new gallery, architect Buontalenti created almost in the middle of the east loggia an elegant octagonal domed room called the Tribuna, into which went the most prized treasures of the Medici collection. The first centerpiece was an octagonal ebony jewel cabinet inlaid with gold, containing precious medals and coins of contemporary and ancient princes and rulers. Around the walls were statuettes, mounds of trinkets, bronze figures by Giambologna, bas reliefs, damascened knives, scabbards with precious jewels. The Tribuna was temple-shaped and was meant to be a temple of the arts. According to its first inventory, made in 1589, there were packed onto its walls 30 paintings—at least five by Raphael, six by Andrea del Sarto, two by Pontormo, plus one by the Flemish painter Civetta and some miniatures by Jacopo Ligozzi.

The contents of the Tribuna changed throughout the centuries as did those of the larger gallery itself, reflecting shifting currents of taste and of art. Before the end of its first three decades the Tribuna had added works by Michelangelo, Correggio, Tintoretto and, a bit surprisingly, Dürer. The Medici interest in northern European painters was born of commercial contact. Already by 1440 Florentine bankers were meeting Flemish bankers, and they exchanged both money and artistic taste. Lorenzo the Magnificent owned a *St. Jerome* by Jan van Eyck, and Florentine banker Tommaso Portinari commissioned from Hugo van der Goes, a leading Flemish painter of the late 15th century, the enormous (eight feet by almost 20 feet) triptych of the *Adoration of the Shepherds* which is now one of the gems of the Uffizi. Van der Goes' huge painting arrived safely, but another 15th-century Flemish painting, Hans Memling's *Last Judgment*, done on commission for Florentine banker Angelo Tani in Bruges, had no such luck. It was captured by pirates and ended up in the Marienkirche in Danzig.

Everyone privileged to see the paintings of the Tribuna admired them, but the octagonal room's most popular piece, for three centuries, has been the serene marble "Medici Venus" (left) which still stands there today. Venus was found probably in the ruins of the Emperor Hadrian's villa near Tivoli, and she suggests the style of Praxiteles of fourth-century B.C. Athens, but beyond that her antecedents are unknown. She turned up in 1638 in inventories of the Medici villa in Rome, and by 1680 she was installed in the Tribuna.

Cleaned and restored for anniversary, Botticelli's *La Primavera* glows once more with luminous grace.

Fold out →

Octagonally shaped, domed Tribuna, in the form of a temple, is a jewel of a gallery within the gallery.

Popular folklore says she was shipped off by Cosimo III because her seductive nudity might prove too distracting to young art students in Rome. Whether this story is true or not, she certainly proved seductive to everyone else. France's Louis XIV ordered a bronze copy made for himself. English gentlemen of the 18th century, it is reported, respectfully kissed her hand. Looking at her today, one wonders which hand. Napoleon made off with her during his incursion into Italy, but the French returned her to Florence in 1815.

As decades passed, the gallery grew and embraced more and more of the cultural arts of Florence. Buontalenti built a two-story court theater in the east wing, the first permanent theater in the city. It presented allegorical and classical entertainments for more than a century, and in 1865-71 was used as the Senate house of the brand-new state of Italy. It was, sadly, demolished in 1890 to make room for the state archives. Little remains today except three enormous wooden roof trusses which were discovered and exposed in recent renovation of the huge Botticelli room.

Shortly after the theater was built, the Medici added another dimension by moving to the west wing

Uccello's *The Battle of San Romano* celebrates the 15th-century victory of Florence over rival Siena.

of the Uffizi the workshops of the state art laboratories —the goldsmiths, wood carvers, porcelain and crystal workers—to join the *fonderia*, or pharmacy, where perfumes were distilled. The *fonderia* also made poisons, antidotes, and miraculous medicines for discreet local use and for presentation to distinguished guests.

Paintings began to edge out antiquity and the minor arts about 1631 when Vittoria della Rovere, Ferdinando II de' Medici's wife, inherited the legacy of the duchy of Urbino, another center of Renaissance art. Vittoria's inheritance included a collection of more than 60 masterpieces, among them Titians, Raphaels, a diptych of Piero della Francesca (right), and works by Palma, Bassano and Barocchi.

Shortly after this great addition, Cardinal Leopoldo de' Medici began sending to the gallery part of his own enormous collection of prints and sketches and portrait miniatures. He widened the horizons of the largely Tuscan emphasis in the Uffizi by adding paintings of the Venetian school—works by Bellini, Giorgione, Tintoretto, Veronese—and his own store of Flemish and Dutch paintings.

If paintings came but slowly to dominate the gallery, it was less because the Medici failed to appreciate them than that they had little precedent for an "art gallery" in modern terms. Objects of antiquity, of curiosity or of intrinsic value, jewels and medals and coins, were appropriate for public display and to make an effect. Paintings were personal. These works, like many of the sculptures which found their way into the Uffizi early on, were dispersed throughout a dozen family dwellings. Political and social influence in their era was inextricably bound up with religion, so there had to be a Medici palace in Rome as well as one in Florence and a succession of villas scattered around the countryside. Four Medici popes and even more cardinals acquired antiquities and works of art for the

Battista Sforza, Duchess of Urbino, was elegantly and dramatically painted by Piero della Francesca.

Raphael's *The Madonna of the Chair*, a 16th-century acquisition, was later transferred to the Pitti Palace.

Other half of husband-and-wife (opposite) portrait was that of Grand Duke Federico da Montefeltro.

Michelangelo's *The Holy Family*, painted to celebrate a wedding in 1504, is his earliest known painting.

Villa Medici in Rome (now the home of the French Academy), and lesser branches of the family filled their own villas with paintings and sculptures.

Among the masterpieces there were both Botticelli's *Primavera* (cover and pp. 63-64), a centerpiece of this year's 400th-anniversary celebration, and the equally famous *Birth of Venus*, which were painted specifically for the Medici villa in Castello, near Florence. The *Primavera* did not move to the Uffizi until 1815, when a burst of enthusiasm for the 15th century fished it out of a storeroom where it had been kept for years. A certain amount of absentmindedness on the part of the Medici caused many another early work to be misplaced or to go astray. Caravaggio's *Young Bacchus*, painted in 1593, turned up to everybody's surprise in a basement storeroom in 1916. Three canvases by Paolo Uccello, the 15th-century master of perspective, were done to commemorate a war with Siena which Florence won in 1432. These hung originally in a bedroom of the Medici palace but by 1598 everybody had forgotten what they represented and they were known simply as "ancient tournaments." They were listed in an inventory of the grand dukes in 1784, and then they were sold. To the present chagrin of the Uffizi, one ended up in the Louvre in Paris, one in the National Gallery in London. Only the third (pp. 65-67) was bought back for Florence.

Early in the 1700s the long Medici line died out and authority passed to the House of Lorraine, a province contested between France and Germany even into our century. It was a happy choice for Tuscany, however, because the House of Lorraine appreciated and took exquisite care of the Uffizi. A "family pact" signed in 1737 between Anna Maria Ludovica, the last of the Medici, and Francis, Duke of Lorraine, handed over the entire family collection with the express condition that no part of it should ever be removed from Florence. The pact was respected. It was in fact a very subtle shift of ownership which made the treasure more the property of the people of Florence than of the ruling house, thus saving it from transfer to other seats of power during the next turbulent centuries.

For the public, identifying labels

It was a Lorrainian, the Grand Duke Peter Leopold, who opened the Uffizi to the public in 1765. For two centuries the Medici had shown the collection to friends, nobility, visiting heads of state, distinguished travelers and scholars. But an opening to the public was unheard-of in that time. Very shortly it became apparent that The Public hadn't a clue as to what it was looking at, so identifying labels for paintings and sculptures were added in 1795. "Works of art ought to be appreciated for their quality alone," wrote one

Masaccio's *The Virgin and Child with St. Anne* was done around 1420 with some slight help from Masolino.

of the Uffizi's first directors in 1793, "but experience teaches us that the name of the artist increases their worth to the public, because many judge the arts from what they have heard or read."

With the rise of Romanticism in the late 1700s the Uffizi began calling back or digging out of depositories the works of the "primitives." An *Annunciation* of Simone Martini (opposite), which had been relegated to a minor provincial church, was installed in the gallery. Also dusted off and hung with pride were the 13th- and 14th-century madonnas of Cimabue and Giotto, the *Adoration of the Magi* by Gentile da Fabriano, the *Madonna and Child With Saints* of Domenico Veneziano and an altarpiece by Botticelli.

Stirrings of revolution in France facilitated acquisition of more than two dozen French masterpieces and the beginning of a worthy French collection. The Lorrainian Ferdinand III made a shrewd exchange of paintings with his brother, the King of Austria, to get from Vienna one of Dürer's most important works, the *Adoration of the Magi*; also Titian's *Flora* and some Rubens works. The suppression of churches and convents during the Napoleonic era sent dozens of masterpieces to refuge in the Uffizi.

By the early 1800s the always-crammed gallery was about to burst its seams, and the age of specialization and spin-off began. A century before, a collection of minor paintings had gone to the Galleria dell'Accademia (now best known for its Michelangelo sculptures), but the real dispersal began in 1859 when most of the post-medieval sculptures and "minor" arts—ceramics, porcelain, ivories, and so on—went to the Bargello museum, and the Egyptian and Etruscan works to form the nucleus of the present Archaeological Museum. Paintings of Fra Angelico went to the friary of San Marco, where the master had done his series of frescoes for cells and chapter house. The scientific instruments went off in installments to found the Natural History Museum and what is now the History of Science collection; the silver and gems went to the Pitti palace.

A very healthy history

Almost miraculously, the Uffizi has never suffered a true catastrophe in all its years. A fire in the west wing in 1762 destroyed 12 sections of frescoed ceilings, along with nine portraits and six statues. Napoleon's depredation was only the Venus, and she was returned. In both world wars the gallery packed its treasures and dispersed them in the countryside to avoid damage both from belligerent action and theft. A pair of Pollaiuolo paintings vanished in the confusion, but they were found in 1963 in Los Angeles and returned to Florence. The Uffizi structure was lightly damaged, and the Vasari corridor was closed because of mine damage after having been used as a clandestine communication line between Italian partisans and the Allies. The flood of 1966 damaged documents and paintings in storerooms but did not touch the gallery.

In honor of this year's anniversary, the Uffizi has restored some major works, redecorated and reopened some highly evocative spaces. Chief among the restored works is Botticelli's *Primavera*. A thin film of dirt and discoloration had collected over the centuries. The airy luminosity of the work was lost, and no one knew for sure what was the true tonality. A "restoration" of a century and a half ago included coating the whole thing with a varnish which was transparent when it was applied but which became darker as the years passed. Technicians at Florence's renowned Laboratorio del Restauro used radiographs, infrared photos and chemical tests to establish the chemical base of both the paint itself and the obscuring film so they could remove the one without damaging the

other. The work done on the *Primavera* took a year.

Elsewhere in the gallery, the Leonardo room has a gleaming new beige-and-brown parquet floor, color-toned to Leonardo's *Adoration of the Magi*, which is the focal point of the room. A display of architectural drawings of the building during its various phases is hung in remains of the old church that Vasari incorporated into the structure 400 years ago. A new storeroom for lesser works of the 1600s and 1700s occupies what was once the Medici post office, and the great hall built in 1780 to house a marble Niobe group has a temporary show of self-portraits of this century. There is an outrageous Rauschenberg, a Van Goghish Manzù, an enchanting Chagall, who painted himself with a blue bird on his head.

These are entertaining diversions, but the glory of the Uffizi is not modern. It is the profusion—and let's face it, confusion—of the riches of four stunning earlier centuries in Italy. Because ours is a commercial age, a committee of art experts 20 years ago tried to value the Uffizi collection and came up with a relatively arbitrary figure of $600 million. It is a figure which could interest nobody except an insurance company. No number of millions could recreate the Uffizi today, neither its fabric nor its contents. And no one could make a better evaluation than did Lorenzo the Magnificent a century before the family treasures even began to be gathered together to make the gallery. Admitting that he found an accounting of expenditure for art to be "unbelievable," he added: "Many deem that it would have been preferable to keep part of the funds in the treasury; I think that our patronage was the great splendor of our regime and, in my opinion, the money was well spent."

Completed in 1333 for Siena Cathedral chapel, Simone Martini's *Annunciation* came to the Uffizi in 1799.

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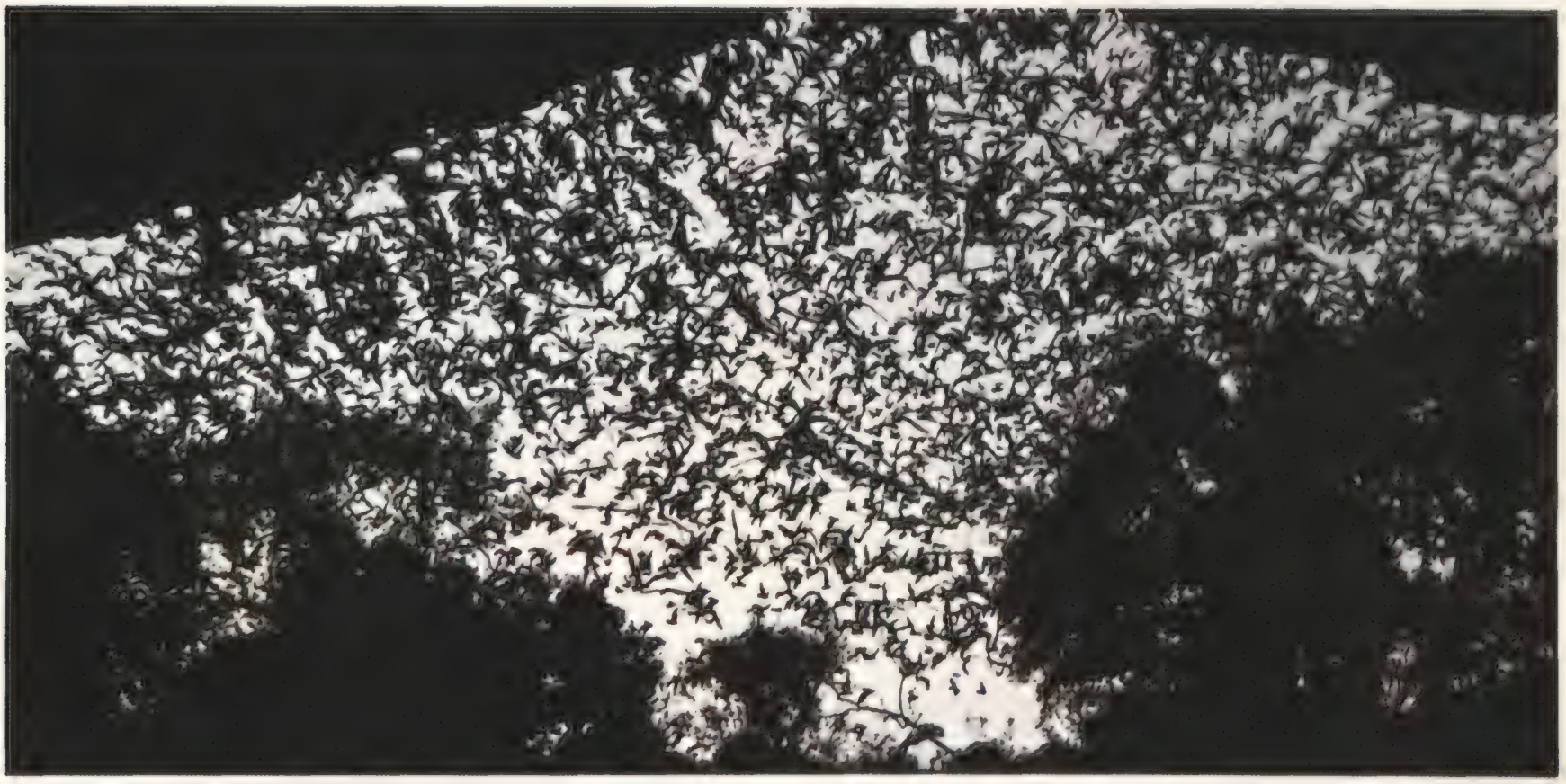
By Donald Dale Jackson

Close encounters with the creatures of another world

Caves would seem to be hostile environments, but thousands of species thrive in the dark, thanks to adaptations and unusual food chains



Mexican free-tailed bats explode out of Bracken Bat Cave in Texas to spend the night hunting insects.

Sunless, devoid of plants, cool and silent as the surrounding stone, a cave seems the very antithesis of life, a rockbound realm suitable only for the creatures that dwell in the human imagination. The idea of a cave as a habitat or ecosystem, as the home of a community of animals, seems a violation of what we think of as a law of nature. No light means essentially no vegetation, and no vegetation means an absence of the primary nourishment that rests at the base of the food web in any ecosystem. The uncompromising blackness of the cave's eternal night also means that the struggle for survival underground is a battle of the blind; eyesight, and thus the whole range of visual signals and clues that guide surface-dwelling species to their sustenance, is useless here.

Though it may resemble E.T., this blind salamander, about 4.5 inches long, comes from a cave in Texas.

Yet the astonishing fact is that many caverns bustle with life. Almost everyone who has ventured beyond a cave entrance knows that bats are often in residence. The most visible cave-dwelling animals, bats are part-time occupants who use caves as bedrooms where they rest between nocturnal hunting forays or while hibernating in the winter. Bears, too, once commonly spent the winter in caves, and European scientists have

Cave dwellers thrive in the dark

Rare cave shrimp lays large-yolked eggs (spheres inside body); young can thus live until able to forage.

found so many fossil remains of one large and now-extinct species in underground refuges that they named it *Ursus spelaeus*, the cave bear. Two kinds of tropical birds, one a Western Hemisphere native and the other from Asia, nest in caves and possess remarkable equipment for navigating in the dark similar to that of bats. But few people know that literally thousands of other species of fish, salamanders, beetles, spiders, millipedes, snails, worms, shrimps and others have successfully adapted to the sunless and food-scarce conditions.

Underground creatures confront a uniquely demanding set of circumstances. Because no food is produced in the cave itself (with the exception of certain bacteria which derive energy from cave minerals), the stuff of life must come from outside. The principal sources are streams and floodwaters which wash organic material such as mud, leaves and aquatic microorganisms into the cave, and the guano, or wastes, deposited by part-time cave residents such as bats, birds and crickets. With this material at the base, the food web spreads out to include bacteria, fungi, worms, beetles, crickets and spiders, on up to crayfish and the fish and colorless salamanders at the top.

Life inside has its advantages

The unpredictability and skimpiness of the food supply are offset to a degree by the few hospitable elements of the cave environment. Except for occasional flooding, for example, weather is not a threat; the storms, ice and freezing temperatures that restrict and jeopardize life on the outside are absent. The high humidity of most caves is another plus, especially for skin-breathing animals like some salamanders, which require moisture to breathe. The cozy size of the cave community—most caves are home to relatively small populations of only a few types of animals—eliminates much of the ferocious competition for food that rages in the streams and forests on the sunlit surface. Tropical bat caves, where the abundant guano provides a life-support system for a large variety of scudders and scrabblers, some of them tourists from the topside world, are an exception.

Biologists divide cave fauna into three categories. Trogloxenes, or "cave visitors," such as bats, crickets and the cave-nesting birds, are temporary residents that go in and out. Troglophiles, or "cave lovers," including several varieties of spiders and many insects, can go either way: some members of a given species live underground while others in the same species do not. Troglobites, or "cave dwellers," are hard-core, full-time, back-to-basics cave inhabitants rarely encountered outside.

All true troglobites, including several types of

Blind crayfish from Twin Mill Cave in Indiana is more delicate, slower moving than surface relatives.

salamanders, fish, insects and crustaceans, are thoroughly cave-adapted and splendidly matched to their environment. They are sightless, though most of them retain some form of useless eyes. They generally lack skin pigment or coloration, since they need no protection from the sun. The loss of sight and pigment yield no obvious advantage in the underground struggle for survival and no disadvantage, but their other adaptations are clearly beneficial. The appendages attached to most troglobites—their legs, antennae and the like—are often longer than those of their outside cousins; this gives them a broader operating range in the constant search for food. Their metabolism is generally lower than that of surface creatures: this enables them to spend less energy and to use what they have more effectively—they need less and live longer. Their reproductive habits are similarly adapted to the limitations of the cave habitat: they produce fewer and larger eggs, and their newborn are consequently bigger and better equipped at birth.

Bats, the animals most closely identified with caves, have perhaps for that reason acquired the same undeserved reputation for sinister menace borne by caves themselves. Widely despised as perpetrators of unspecified evils, tarred by legends assailing their character, they are in fact guilty of nothing more serious than unacceptable ugliness—a judgment that requires a close-up view that most people are willing to forgo—and a rare outbreak of rabies. Both the rabies and the bulk of their unsavory repute derive from the vampire bats of Mexico and Latin America, and more specifically from their taste for warm blood, but the bias against these blunt-featured, silken-winged mammals is lamentably indiscriminate.

For those willing to stifle their prejudice, bats are well worth getting to know, if not individually then perhaps collectively. The several species that spend part of their time in caves are reasonably clean, generally harmless, and possessed of extraordinary navigational and thermostatic equipment that outfits them perfectly for subterranean life. Their delicately tuned sonar, an object of mystery as well as wonder until scientists finally explained it about 40 years ago, enables them to avoid an intruding cave explorer or any other obstacle in their flight path, while their remarkable ability to adjust their metabolism and body temperature downward during hibernation permits them to survive the long foodless winters.

Some types of bats migrate to warmer climates in the winter, returning each spring frequently to the same cave they occupied the year before; others winter by clinging to the limestone walls or ceilings by the claws on the ends of their toes, or by retreating into crevices in the cave, and lapsing into a trance so deep that it is difficult to distinguish a hibernating bat from a dead one. Their body temperature drops to that of the air around them, sometimes only a few degrees above freezing. Heart rate, respiration and blood circulation all slow down proportionately. The fat stored up during the warm season has to last a hibernating

This article was adapted from Donald Dale Jackson's book Underground Worlds, *published this month as part of the Time-Life Books series "Planet Earth."*

bat until the following spring; any movement, with its consequent drain on stored reserves of energy, threatens the bat's survival by shortening the time it can live on its reserves; if it wakes up too often, it may starve. When a bat awakens in the spring, its metabolism speeds up. Its heartbeat increases more than a hundredfold, and its body temperature climbs at a rate of about two degrees per minute. Soon its temperature is back up to normal and the bat is ready to resume open season on moths, flies and other insects.

Vampires, the outlaws of the bat world, acquired their fearful name when the conquistador Cortés and his troops returned to Europe from Mexico bearing tales of a bloodsucking night-stalker eerily reminiscent of the demonic creatures of medieval legend. Vampire bats walk up to their sleeping victims—most often horses, cattle and other livestock—and slice the skin with surgical precision, lapping up the resultant blood so quietly and efficiently that the unwilling donor seldom arouses. The bats' saliva contains a chemical which prevents the blood from clotting, while its flattened nose facilitates an unimpeded strike with its sharp upper incisors.

They are not averse to sipping human blood on occasion, a fact that was on my mind when a Mexican college student and I ventured into a shallow vampire cave some years ago. Annoyed by our lights, the bats fluttered into action and began flapping wings that stretch some 15 inches from tip to tip, flying close enough to my head to cause me to question their intentions. My guide assured me that they preferred their prey asleep and motionless, and backed off if their target stirred. "They are only *nervioso,* Señor," he said. A trifle *nervioso* myself, I kept moving—toward the entrance.

The floor of a vampire bat cave is coated with the dark tarlike guano that results from a blood-only diet, but the passageways in the caves inhabited by insect-eating bats are perhaps even more repugnant—except to the beetles, cockroaches and other species that find sustenance there. A shower of parasitic mites, which live in the bats' fur, rains continuously onto the floor. Beetles, flies, mites and moth larvae swarm over the foul-smelling guano. A dead bat falling into the heaving carpet of guano is quickly consumed.

Archaeologist M. R. Harrington, crunching through a guano cave in Cuba some years ago, glanced at the walls and spotted several large, tailless whip scorpions, equipped with an extra-long pair of legs for prey detection and long arms for clutching their victims. A large centipede scudded by with a cockroach in its mouth. Harrington then spied "a mound of fighting, struggling cockroaches and kicked them aside to see what they were after. It was a baby bat, already half picked to a skeleton." He allowed himself to wonder what might happen if he fainted from the stench and fell. "The same idea must have struck all of us at the same moment," he wrote, "for we turned and beat a retreat without a word."

The fascinating oilbirds, or *guácharos,* crow-size birds which roost deep within caves in Trinidad and northern South America and unleash a brain-rattling screech when disturbed, are one of only two known types of birds that share the bats' sonar system (p. 80). The Indians of northern South America traditionally viewed the *guácharos* with a mixture of mystical dread and practical gratitude: the caves they occupied were thought to be the eternal resting places of ancestral human spirits—to "go to the *guácharos*" meant to die—while oil extracted from the bodies of the chicks was used for cooking and illumination. Alexander von Humboldt, the German explorer-scientist who introduced these oilbirds to European science early in the 19th century after a visit to Venezuela, described how the natives dislodged the birds' nests from fissures high up on cavern walls with long poles and then sliced open the chicks' abdomens.

Like bats, oilbirds spend their days in their cave

Blindfish, a brotulid, found in the Yucatán area of Mexico.

A cave-dwelling millipede from Cueva de la Capilla in Mexico.

This leggy cricket lives in Links Cave in southwestern Virginia.

retreats and their nights foraging for food in the surrounding forest, primarily fruit. Back in the cave, they frequently drop seeds that become rich nourishment for cave animals. Some seeds germinate in the guano and struggle bravely into stunted white plants—"blanched stalks, with some half-formed leaves," Humboldt called them—which grow to a height of about two feet. Beetles, four-inch-long cockroaches, cave crickets and whip scorpions with legs that span a foot and a half scramble through and devour the miniature bleached forest. Venezuela's Guácharo Cave, which houses the world's largest colony of oilbirds—19,000 by a recent estimate—has been off limits to oil-gatherers since it became part of a national park in 1949.

The only other known sonar-equipped birds are the Asian swiftlets. One species, an inhabitant of Malaysia and Indonesia, builds the nests coveted by Chinese gourmets for "bird's-nest soup." These nests, constructed of solidified saliva secreted by the birds, have been gathered for centuries by daredevils swaying on high bamboo or rattan ladders. Recent research has shown that the cave-dwelling swiftlets, like the oilbirds but unlike bats, use their sonar for navigation only and not for hunting.

The blind salamanders found in a number of European and American caves may be the most peculiar and puzzling creatures in the underground menagerie, a distinction that embraces their history as well as their appearance and life-style. The first recorded cave-dwelling salamander floated into view in 1689 after a nobleman broke off a stalagmite blocking a stream course in a cave in what is now Yugoslavia. Pinkish-white, eyeless and perhaps a foot long, supported by an odd-looking set of three-toed front feet and hind feet bearing two toes each, this unlikely beast was clearly, in its discoverer's eyes, a new and pint-sized species of dragon.

The truth, as it gradually emerged over the next two centuries, was hardly less fantastic. The "dragon" was actually a salamander which came to be known as *Proteus*. Born with rudimentary but sightless eyes, *Proteus* loses them as it matures until not even the sockets are recognizable. It progresses from a dark gray color at birth to a pigmentless white adult tinged pink by its blood vessels. It possesses lungs as well as a set of feathery red gills on either side of its neck. It appears to be sensitive to light in spite of its blindness, though precisely how remains one of its many secrets. Another puzzle is how it manages to live so long (some say up to 25 years), and how it can apparently survive for years with little nourishment.

The first clue that the European *Proteus* had an American cousin came in an 1885 *Scientific American* article which included "white, blind lizards" among the curious creatures found in Marble Cave in Missouri, now known as Marvel Cave. Six years later a single specimen of what would come to be known as the Ozark blind salamander was plucked from another Missouri cave and dispatched to the Smithsonian Institution. Scientists subsequently gathered enough of them to see that they differed from *Proteus* in several striking particulars. Where *Proteus* maintains its larval form throughout its life, for example, the Ozark species metamorphoses from a fairly dark, relatively stocky creature with small but functioning eyes to a slender, pale and sightless adult. Its eyelids grow together as it matures. While *Proteus* owns both lungs and gills, its New World relative begins life with a set of gills and loses them in metamorphosis, breathing thereafter through its skin. Some Ozark salamanders in the larval stage also make occasional forays to the world outside the cave.

The American branch of the family doubled in 1896 when a crew of well drillers near San Marcos, Texas, saw several skinny white salamanders of a sort previously unknown rise to the surface from a stream they had tapped 188 feet underground. The Texas species (p. 74), a lifelong larva like *Proteus*, turned out to have

A troglobite crab roams Cueva del Tio Ticho in Chiapas, Mexico.

Also from the Yucatán is this cave eel, *Ophisternan infernale*.

Frog just inside a Texas cave is a trogloxene or "cave guest."

even more degenerate eyes, long toothpicklike legs and a blunt spoonlike snout equipped with sensitive vibration-detecting nerves. A pair of wispy scarlet gills protruded from its white neck, while the fragile legs ended in a cluster of appendages with a somewhat startling resemblance to tiny human hands.

The discoveries of the Ozark and Texas blind salamanders have been followed in recent years by the documentation of seven more species in America—four in Texas, one in Georgia and two in the Appalachian region—in addition to several others which still await scientific analysis. They differ from one another in bone structure, pigment, length of limbs and eye development, or the lack of it, and in many other features. Scientists believe that the various species illustrate an evolutionary progression, that those with less pigment, longer legs and more reduced visual equipment are farther along the road in adapting to the cave habitat. "The preadapted types"—those which have already evolved some of the qualities necessary for subterranean survival—"are moving toward the open ecological niches in the caves," says Dr. John R. Holsinger, a biospeleologist at Old Dominion University in Norfolk, Virginia. Holsinger has identified a pale, broad-snouted species he found in West Virginia as among those becoming more cave-adapted.

Blindfish in limestone caverns

Blindfish, first discovered in Mammoth Cave's River Styx in Kentucky in the early 19th century, have accommodated themselves to underground life with the same low-key efficiency that has worked so well for salamanders. Originally misidentified as a type of catfish, the small (about four inches at the longest) white fish found in Mammoth and other caverns in some of America's limestone areas owes its success primarily to a network of sensitive ridges on its head and jaw which permit it to detect movement—and thus find a meal—in the quiet pools it inhabits.

Like other cave colonists, the fish have developed a cluster of characteristics which equip them for survival in the dark. Longer fins and larger heads than those of comparable outside species help them find the worms, crustaceans and other aquatic organisms they prey on. They appear able to "remember" their own position and the location of the obstacles in their territory. Their low metabolism prolongs their life and enables them to conserve energy, as does their leisurely but purposeful swimming style, giving them what amounts to more miles to the gallon. The only predators they had to worry about were the Kentucky souvenir-stand operators who caught them and sold them to tourists.

Crayfish, the most prominent crustacean cave

Inside of Bracken Bat Cave, millions of bats roost during the day, adding guano to the food web.

Oilbirds rest by day in a Trinidad cave; at night they may fly 50 miles or more to find ripe fruit.

Found from Virginia to Oklahoma, commonest cave salamanders have eyesight, live in twilight zone.

dwellers, have developed a clever reproductive strategy which apparently depends on the workings of their "biological clock," the imperfectly understood phenomenon which somehow allows an animal to make the right move at the right time. A study of blind crayfish in an Indiana cave showed that they laid their eggs at a time coinciding with the period of maximum flooding in the spring, even when the floods arrived in different months. The production of sperm and eggs is apparently controlled by their clocks, while the high water triggers the actual laying. The young hatch in midsummer, the season when the available food supply is at a peak.

Cave crustacean an evolutionary relic

A recently discovered crustacean appears to be one of the most singular cave creatures ever found, a member not just of a new species, but also a new genus, new family, new order and new class. Four specimens of this blind, unpigmented animal were found by biospeleologist Jill Yager and her cave-diving companions in an underwater cavern on Grand Bahama Island. "It looked like a worm with legs," said biologist John Holsinger, who was summoned to inspect the find. "It's apparently an evolutionary relic." Holsinger explained that most crustaceans have specialized body segments with different appendages used for different purposes. The newly named *Speleonectes lucayensis,* by contrast, has a series of undifferentiated and unspecialized segments. It is apparently related to a primitive evolutionary ancestor of hundreds of more highly developed crustaceans.

The organisms that creep across cave floors, skitter along the walls or weave soundlessly through the streams—the spiders, crickets, beetles, millipedes, mites, springtails, shrimps, amphipods, isopods and dozens of others—account for the largest part of the seen and unseen life underground; there are more than 200 known species of beetles in American caverns alone. Many of these creatures, like the spiders and scorpions that patrol tropical bat grottoes, can function either inside or outside caves, but many others are permanent cave residents with the survival tools that go with the territory.

Most cave crickets, for example, commute to the surface regularly in quest of food, returning to the same underground alcove after every trip. But one type, equipped with antennae four times as long as its body, has become so adapted to the unchanging temperature below ground that it cannot survive outside.

The blind rhadinid beetle, another well-adjusted troglobite, dines almost exclusively on the eggs that crickets deposit in the silt of the cave floor. One of the few cave species with such a specialized diet, the rhad-

inids are built perfectly for the purpose: sensory organs on their antennae guide them to the eggs, which they puncture with their sharp tonglike mandibles. Another cave-dwelling beetle ensures the survival of its kind by laying fewer and larger eggs than its relatives above ground. The yolks contain so much nourishment that the young need no food at all for the seven to nine months it takes them to mature.

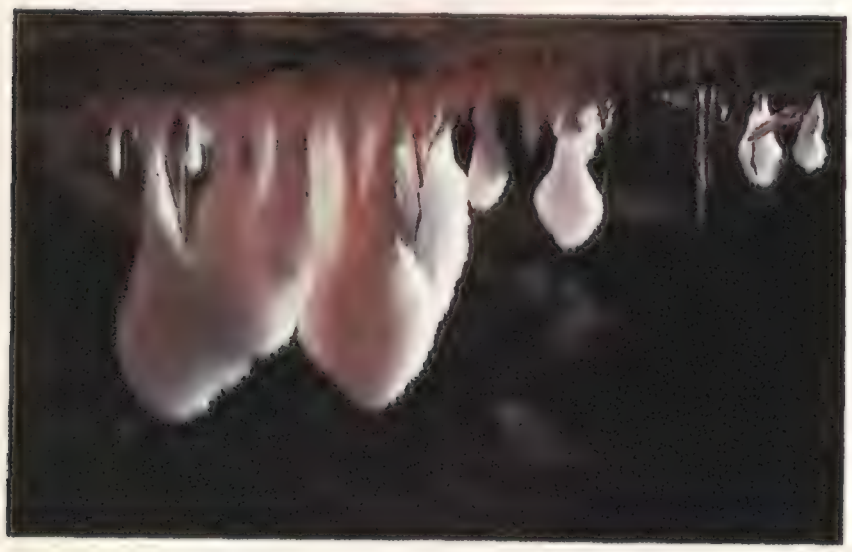
The crowd-pleasing glowworms of the Waitomo Caves in New Zealand are the only cave creatures other than cavers and tourists that come equipped with their own light source. Visitors are enchanted by the galaxy of blue-green lights on the dark ceiling, lights that the insects use not for illumination but for luring unwary prey. The glowworms, common in aboveground ravines as well as caves, are actually the larvae of a species of gnat. Beneath each insect shining in the cave dark is a sticky thread known locally as a "fishing line," as much as a yard long, that snares flying insects attracted by the light. The glowworm reels in its victim, eats it, then tidies up the line before casting again.

How do cave animals get that way? How do they establish themselves in caves in the first place? Once there, how do they develop or retain the characteristics that help them survive while losing those, such as eyesight and pigmentation, that are useless? Can the evolutionary principle of natural selection explain the regression of features which are neither positive nor negative but neutral?

Biologists are still probing for the answers, and only the broad outlines of an explanation are visible. It is widely believed that cave-dwelling creatures have evolved from preadapted ancestors; that is, the habits of their ancestors made them likely candidates for life in the dark. Salamanders and beetles that prefer moist dark places above ground might naturally gravitate to the even damper and darker atmosphere of a cave. The graces of subterranean life—the absence of weather extremes, minimal competition, the scarcity of predators—might induce them to stay. As generation succeeds generation, they might find fewer and fewer reasons to leave. Eventually they may become cave-adapted.

But before a new cave species can evolve it must be isolated from others of its kind to preclude interbreeding. Scientists believe that many surviving troglobites in temperate regions originated during or before the last wave of glaciers in the Ice Age. Climatic changes might have forced the aboveground population to migrate, resulting in the isolation of the cave colonists. Long-term confinement in the stable cave environment also accounts for the occasional survival of more primitive evolutionary forms like the crustacean recently found in the Bahamas.

The cave habitat, with its unique stability and simple food web, is as close to a self-contained ecosystem —saving only its dependence on outside sources for the first strand in the web—as any in nature. It is tempting to believe that the sturdy masters of making-do underground could better survive the various horrors that threaten the rest of us—toxic fumes, the exhaustion of our resources, nuclear war—even though they must retain their links to the outside world for air, water and food. It certainly seems possible that we can learn something from them "about population control," John Holsinger suggests, "or perhaps energy conservation." More generally, Holsinger observes, "We're going to have to evolve ways to get along with less"— a dilemma that cave creatures solved long ago.



Fungus grows down from a log wedged in Salamander Cave in Virginia; longest growth is about six inches.

Harvestman, or daddy longlegs, navigates stalactites inside Spruce Run Mountain Cave in Virginia.

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Bell System

By Timothy Green

City of London, where money makes wheels go round

Emblem of the City, a griffin stands at each principal entrance. This one is at Holborn, before Staple Inn.

Ever since Roman times this mile-square enclave within the metropolis has been celebrated as 'a busy emporium for trade'

In 1817 Washington Irving noted after a visit to London that "The Lord Mayor is looked up to . . . as the great potentate upon earth; his gilt coach and six horses is the sum of human splendour; and his procession, with all the Sheriffs and Aldermen in his train is the grandest of earthly pageants." Many a rubbernecking modern tourist would agree, if he has the good fortune on the second Saturday in November to join the throng lining the sidewalks of the City of London to watch the cavalcade pass by en route to Mansion House after the installation of the new Lord Mayor. The pageantry is a sure sign that the City of London still flourishes as a commercial capital, as it has since the time of the Romans (the historian Tacitus then knew it as "a busy emporium for trade").

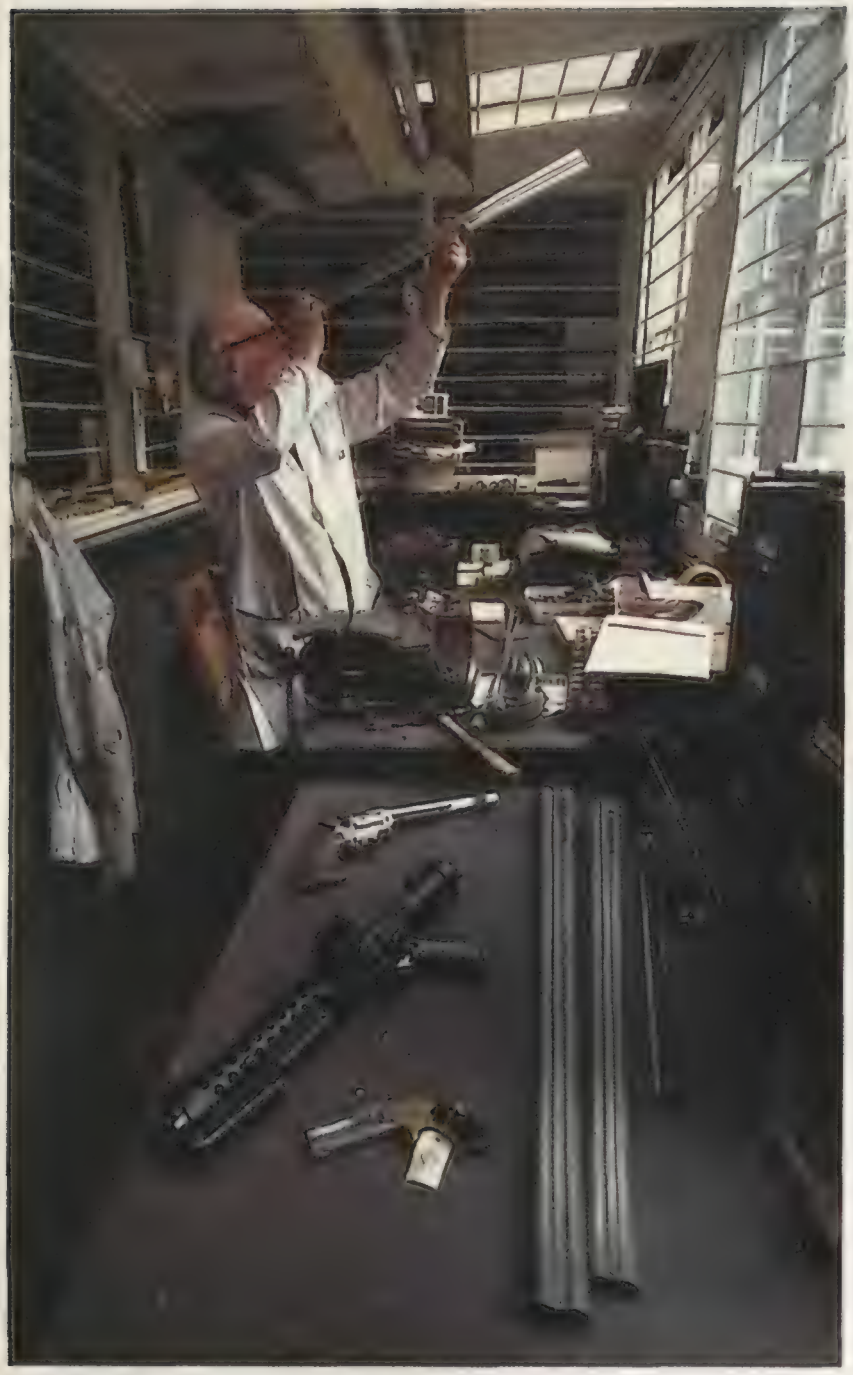
The stranger also has to learn the subtle English distinction that London and the City of London are two entirely different communities. While Greater London is a sprawling metropolis of nearly seven million people, the City is precisely 677 acres—just a square mile on the north bank of the River Thames that is bounded by the former Roman and medieval walls. By day the City is crowded with 350,000 office workers; by night it is a ghost town inhabited by scarcely 6,000 people, although enlivened somewhat by the opening of the Barbican Centre for Arts and Conferences, which draws theatergoers to the new home of the Royal Shakespeare Company, and music lovers to the adjoining concert hall where the London Symphony Orchestra has taken up residence.

Yet the Lord Mayor's little domain contains the world's greatest concentration of financial services; they earn Britain about $5 billion in "invisible" overseas trade each year. Side by side within the narrow maze of streets are the Bank of England, the Stock Exchange, the insurance emporium of Lloyd's, the Baltic Exchange for shipping contracts, the London Commodity Exchange for trading coffee, rubber, sugar or wool, and the London Metal Exchange for dealing in copper, silver or zinc. Banks abound. Not only do the major British banks have their head offices along Lombard Street, but 385 foreign banks have branches or representatives in the City, including some 70 from the United States. Most have set up shop as the City became the heart of the Eurodollar market, which trades the vast "offshore" pool of American dollars.

The great merchant banking houses of Rothschild and Baring Brothers (who financed the Louisiana Purchase for President Jefferson in 1803) are close at hand. Rothschild's, incidentally, play host to their fellow members of the London gold market at the twice daily price "fixing," which has long been the worldwide benchmark for the metal. Actually, the oldest members of the gold market are Mocatta & Goldsmid, who trace their history back to 1671, and their historical

Hallmark of City bigwigs, a Rolls-Royce is parked at Mansion House, the residence of City's Lord Mayor.

Photographs by Michael Freeman



At 350-year-old Gunmakers Company, "proof master" Alfred Bedford inspects a shotgun barrel.

Dome of St. Paul's, masterpiece of Christopher Wren, is framed by towers of old Cannon Street Station.

credits include helping Rothschild's drum up the essential gold coin to finance the armies of the Duke of Wellington as he set out to beat Napoleon.

Such longevity is commonplace. The Governor and Company of Adventurers of England Trading into Hudson's Bay established by King Charles II in 1670 still holds regular fur auctions (under the shorter title of Hudson's Bay Company) at Beaver House. And the "Old Lady of Threadneedle Street," the Bank of England, opened its doors in 1694.

The lifeblood of the City may be financial wizardry, but tucked beneath glistening new skyscrapers remain less secular treasures of its past. Nothing could be finer than some 20 churches designed and built by Sir Christopher Wren. Indeed, it was Wren's architecture that restored the City after the devastation of the Great Fire in 1666. Although his masterpiece is St. Paul's Cathedral, whose majestic dome rises 365 feet over the City (above), the charm of his architecture is still to be found at every turn. The graceful spire of St. Mary-le-Bow, a campanile 225 feet high that Wren built between 1670 and 1683, soars over Cheapside.

By Wren's day the City was not only challenging Amsterdam as the commercial capital of Europe, but its unique civic status was also well established. William the Conqueror in 1066 had found he had to guarantee the City its traditional laws and freedoms before its merchants would recognize him as King. In 1215, the citizens won a charter from King John granting them the right to elect a Mayor annually. By unbroken tradition this election takes place on September 29—Michaelmas Day—when liverymen of the ancient guilds choose two candidates who have once served as sheriff from the City's 25 aldermen. The final choice is then made by the Court of Aldermen.

In truth, the selection is a ritual. The real hurdle is

Coinage from Royal Mint is tested, as it has been since 1248, in "Trial of the Pyx" in Goldsmiths' Hall.

to be chosen initially as an alderman, one of whom by seniority becomes Mayor. Political campaigning to be alderman or Mayor is unknown. Indeed, you can calculate, within a year or two, who will be Lord Mayor ten years from now. The short-term forecast meanwhile is that a woman will succeed to the title in 1983 or 1984, for the first time in 800 years. She is Lady Donaldson, a former nurse and juvenile court justice, who already is sheriff under the present Lord Mayor, Sir Christopher Leaver, who at 44 was the youngest in this century. On November 13, Anthony Jolliffe, also 44, an accountant and member of the Painter-Stainers Company, will succeed Sir Christopher.

The Lord Mayor serves for one year (although Dick Whittington, perhaps the most famous Lord Mayor, did hold office three times some 600 years ago). During his tenure he resides in the splendid opulence of Mansion House, coping with a nonstop social and ceremonial round that requires him to make 800 speeches. The City stumps up a $160,000 allowance, but it costs him $60,000 or more from his own pocket. He is no mere figurehead. He is the chief magistrate, sitting regularly in a small courtroom actually within Mansion House (the only court in a private house in Britain). And visiting heads of state call upon him to receive the City's official welcome, and may be entertained at lunch or dinner in the ancient Guildhall, dating from 1411. When he travels abroad, he also effectively rates ambassadorial status. Last summer Sir Christopher Leaver upheld the British flag in Chicago on an official visit to Mayor Jane Byrne.

Within his own domain the Lord Mayor is undis-

No stranger to the City, London-based author Timothy Green wrote about Lloyd's, one of its institutions, in the March 1981 SMITHSONIAN.

Seated on a dais at left rear, Lord Mayor presides at Court of Common Council meeting in Guildhall.

puted premier citizen; only the reigning sovereign takes precedence. Even then the monarch treats the Lord Mayor with due respect; if Queen Elizabeth visits the City, he greets her at Temple Bar to offer her the sword of the City, symbolizing her temporary authority over his territory.

The Lord Mayor also presides over the Court of Common Council, which has ruled the City since the late 13th century. The Court, composed of aldermen and 130 Common Councilors, shapes policy on housing, planning, health and finance (above).

The City also has its own police force just for the square mile; they are distinguished from men of the Metropolitan Police in adjoining streets by crested helmets and gilt buttons. The City Police, incidentally, maintain a strong fraud squad to discourage corruption in a community where finance is paramount.

The City's sway also extends to four bridges over the River Thames, including Tower and London Bridges. When the present London Bridge was rebuilt, the City, in a resourceful $2.5-million deal, sold the old bridge as a tourist attraction to Lake Havasu City, Arizona (where the City owns a souvenir shop and pub).

The City keeps a watchful eye, too, on its major wholesale markets: Billingsgate for fish, Smithfield for meat and Spitalfields for fruit and vegetables. In all of them the day dawns early. By 5 A.M. Smithfield's porters are already shouldering sides of beef and legs of lamb onto racks at the 300 stands of meat wholesalers. The bustle of buyers includes not only butchers from all over London, but chefs from hotels, restaurants and even the royal kitchens at Buckingham Palace if a state banquet is in prospect. The Cock Tavern and other neighborhood pubs open early so that thirsty workers can down a pint. The early morning rumpus down by the Thames at Billingsgate, however, is no more: the market where fish has been hawked for 600 years moved last year to new quarters just outside the City's precinct (but still under its authority) in the adjoining borough of Tower Hamlets.

The markets are a reminder that the original power base of the City was its guilds and livery companies, which controlled virtually every trade and profession. A Guild of Butchers existed as far back as 1179 and the Fishmongers Guild won its first royal charter in 1272. The Mercers, Grocers, Drapers, Goldsmiths and Salters rank among the oldest and wealthiest companies that once dominated the commercial life of the City. Each company exercised tight restrictions on its respective trade, maintaining standards and determining who could practice. Transgressors were swiftly banned. Moreover, the companies' influence extended

so far beyond London that an expelled butcher, baker or candlestick maker had to move at least 100 miles north to Coventry to carry on working. It is said that the phrase "sent to Coventry," which in Britain still designates someone shunned by his fellow workers, originated from this practice.

The real power of the companies lasted until the early 19th century, when they were no longer permitted to exercise a "closed shop." Yet instead of their number diminishing as influence waned, they have actually increased to embrace many modern professions. Today there are 93 companies with 18,000 members, including such newcomers as Air Pilots and Air Navigators, Chartered Accountants and Scientific Instrument Makers. Marketing men have even founded the Worshipful Company of Marketors. Changing times have forced some older companies to adapt their skills. Thus the Armourers and Brasiers, originally formed in 1322 from makers of armor, maintain their interest in the technology of metallurgy, while Fanmakers have broadened out to include air conditioning and central-heating engineers.

Member of a medieval artillery company walks beside the Lord Mayor's coach at inaugural.

Gold articles by the millions

Although most companies are now essentially social and charitable institutions, a few still exercise strict controls within their professions. The Worshipful Company of Goldsmiths (p. 89), for instance, employs 180 people in its assay office which hallmarks gold, silver and platinum objects, stamping each item with three marks—for purity, date and town (*i.e.*, for London). "Our record was 15½ million articles in one year," said Assistant Deputy Warden David Dalladay, as we inspected boxes filled with gold chains, wedding rings and silver spoons. White-coated laboratory assistants take random samples, and scrape off small pieces of metal to be analyzed by standard chemical methods. "We've marked everything from silver elephants for Indian maharajahs to one-gram earrings."

Rather noisier tests were going on at the Worshipful Company of Gunmakers a few streets away, where guns have been proof-tested since 1637. "Every gun made in the United Kingdom or imported to be sold here must be checked," said Alfred Bedford, the "proof master," emerging from the fortresslike "proof house" where he and six colleagues blast away to check the pressure and velocity of nearly half a million guns a year (p. 88). Although two-thirds of the weapons are revolvers, rifles and submachine guns, the gunmen devote special attention to shotguns. They must pass a double inspection. Initially tubes destined as shotgun barrels are submitted for "provisional proof"; a heavy charge is fired through each. If it passes, the tube is stamped with a lion. The manufacturer can thus com-

Silver-badged oarsmen who won annual race on the Thames are vivid part of Lord Mayor's Show.

A Mad Hatter's Tea Party is a *Wonderland* event at the Barbican Centre, the City's new arts complex.

Seen from Mansion House: Bank of England (left), pillared Royal Exchange, Royal Insurance Company.

plete the weapon confident that it does not have weak barrels. The finished shotgun then goes back to the Gunmakers for "definitive proof" with black and nitro powders, and new "proof marks" are stamped on the barrel and action. The cost is only $3.25 per barrel.

The companies' contributions to the City vary remarkably. The Worshipful Company of Gardeners organizes a scheme for flower-filled window boxes at many offices. The Farriers Company, which has been dedicated to "preserving of horses by preventing their destruction by bad shoeing" since 1674, issues the credentials of shoeingsmiths after a series of nationwide exams. Two of the Farriers' most active members are Britain's best-known horsewoman, Princess Anne, and her husband, Mark Phillips.

Honorary membership in companies is often accorded to royalty and politicians. Prince Charles belongs to the Worshipful Company of Fishmongers, and Prime Minister Margaret Thatcher to the Poulters.

While the livery companies owe their origins to the City's medieval past, the major financial and commercial institutions mostly trace their roots to the coffeehouses that first flourished in the 17th century. Bullion brokers like the Mocattas held court at Grigsby's cof-

feehouse, West Indian traders convened at the Jamaica, and insurance brokers met at Edward Lloyd's coffeehouse, the hub of maritime gossip. The insurance men moved into their own quarters in the Royal Exchange in 1774. The name Lloyd's, however, stuck (SMITHSONIAN, March 1981).

Just around the corner from Lloyd's is the only international shipping exchange, the Baltic, which also grew from coffeehouse roots. Sea captains and merchants used to meet 250 years ago at the Virginia and Baltic coffeehouse to bargain about cargo shipments. Nowadays they congregate on the open floor of the Baltic Exchange between noon and 1:30 P.M. to fix contracts involving 70 percent of the world's bulk cargoes. "If someone wants 20,000 tons of grain shipped from the West Coast of the United States to Japan next week, he'll arrange it here," said the Exchange's Gordon Bradley as we watched the murmuring throng. The latest gossip is eagerly gleaned. "If Australian dockers go on strike, it's known here in minutes," he added, "because it could mean ships delayed in port."

Although the first known joint-stock company in Britain, the Muscovy Company formed in 1553 to trade furs with the czars of Russia, predates even the coffeehouses, early stockbrokers frequented New Jonathan's and Garroway's coffeehouses until the actual Stock Exchange opened in 1801. Initially there were 500 members, and the stocks they dealt in already underlined Britain's imperial role—Navy, India Stock, India Bonds, South Sea Stock, Irish 5 percent and Imperial 3 percent were on the original listing. Such international flavor is preserved today; of 3,000 companies quoted, almost 400 are foreign. The 75 American firms quoted include Bethlehem Steel, Chase Manhattan, Ford, Quaker Oats, Rockwell and F. W. Woolworth. A prime difference from U.S. exchanges, however, is the unique trading system. The 4,000-some members of the Stock Exchange (who include 35 women) are split into two groups, brokers and jobbers. The investor places his order with his broker, who then buys—or sells—through one or more jobbers specializing in a particular stock. Each deal is a private transaction that broker and jobber pencil into notebooks and guarantee with the Stock Exchange's motto, "My word is my bond." Such intimacy of trading means there is no instant ticker report of volume as in New York. But later totting up confirms volume far beyond any stock exchange outside the United States and Tokyo.

The real secret of the City, however, is not so much any single institution as the weaving together of the combined strengths offered by many. "The lure of London is the sheer range of financial services instantly on tap," says Hugh Dwan, managing director of the Hudson's Bay Company. "If a client buys 25,000 mink at one of our auctions, at £15 each, he needs a quick £375,000. In the City he can raise it in two hours. The ability of the merchant banks or other specialist financiers to back what looks like a profitable deal is far greater than anywhere else. In fact if you can't make a deal here, it's probably a rotten deal."

Traders flock onto floor of the Stock Exchange at the opening of business. Only two are top-hatted.

A more subtle asset is the City's strategic placing in the time zones. Eager young foreign-exchange dealers are at their desks by 8 A.M. to catch the Tokyo and Hong Kong markets' closing; they stay on until 6 P.M. to cover New York's opening. As one observed, "We can deal with the whole world in a single working day."

Such experience is a great attraction to U.S. bankers, who often regard a stint in a City dealing room as an essential stepping-stone to top management at home. "American banks tend to be more provincial because the domestic money market is so large, but here you learn to think international," says Fred Vinton, general manager of Morgan Guaranty, which has had City offices for almost a century. "A guy from Brooklyn in a New York bank may know what a Canadian dollar is, but in the City a chap from the East End of London knows all about yen, deutsche marks and French francs. It's a world of difference."

A Zandra Rhodes fashion exhibition splashes color at Conservatory of the City's opulent Barbican Centre.

The villagelike intimacy of the City also means that it is a veritable club. Nothing exemplifies that better than the lunches. While lesser clerks may gather over a pint in such favorite pubs as the Jamaica Inn, the Throgmorton or the George and Vulture, executives convene in the private dining rooms of banks and business houses to sample some of London's best cuisines.

For those with a spare lunch hour, however, the City offers unique treats. If you can grab a beer and a sandwich in five minutes, you can sample a stunning range of 50-minute recitals and lectures in the nearby churches and museums. On a typical day last summer, the choice lay between a viola and piano recital at St. Olave's church, organ recitals in two of Sir Christopher Wren's finest churches, a clarinet and piano recital at yet another Wren church, St. Martin's-within-Ludgate, or a talk on "London's silver in the 18th century" at the Museum of London.

The artistic attractions have increased with the opening of the Barbican Centre for Arts and Conferences, in which the City has invested $240 million to boost its cultural amenities. The Centre, the largest in Europe, puts on everything from lunchtime jazz on a broad terrace by an artificial lake to brief, cheap ($1.80 a seat) concerts in the new 2,026-seat auditorium. City workers are showing up in droves; when the London Symphony Orchestra played its first lunchtime session, 300 people had to be turned away.

The Barbican's Concert Hall and two theaters for the Royal Shakespeare Company, together with three small cinemas and an art and sculpture gallery, mean that the City at last shows some life in the evenings. Instead of the commuter rush home at 5:30, office workers now head for the bars in the Barbican's immense foyers, and listen to free informal concerts before settling into the main theater to watch *Henry IV, Part One* (in which Falstaff and Prince Hal drunkenly explore the very streets around the Barbican).

A fresh alliance between the Arts Centre and the financial world outside was forged from the start; the stimulating inaugural production of *Henry IV*, with realistic rough-and-tumble battle scenes, was subsidized by a special grant from a leading commercial bank, the Midland, whose headquarters is a few hundred yards away. As the Lord Mayor, Sir Christopher Leaver, stressed at the opening ceremony, in which he presented the Arts Centre as a gift to the nation, "The City has a tradition of generous and altruistic support for education, charity and the arts. This imaginative enterprise adds a new dimension to its life and history."

City of London stockbroker, one of a half-dozen who still dress traditionally, walks past Bank of England.

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By Jeanne A. McDermott

The kaleidoscope, magic in a tube, is enjoying revival

All the rage after their invention in 1816, these artful instruments reach back in time while embracing the latest in technology

Sequins, stained glass, beads, jewelry filigree and seashells—suspended in oil—form a Reynolds image.

At the fair, the crowd lingered around Stephen Auger's kaleidoscope booth. Most strollers found the opportunity to peep as irresistible as peanuts. One woman grabbed the nearest tube, peered into the eyepiece and flicked open her purse to make a purchase without a moment's hesitation. An elegantly garbed advertising executive hovered at the crowd's edge, carefully scrutinized the wares and mysteriously returned three or four times before questioning Auger at length and buying one of each. "One guy methodically looked through every kaleidoscope not once but three or four times until he found *the one* with a perfectly flawless image," relates Auger, a 26-year-old artist based near Northampton, Massachusetts, who supported his studio work for two years by re-creating the kaleidoscope's marvels.

Even when made from crushable cardboard tubes, sheathed with paper more gaudy in color than the plastic chips that sometimes create the inner image, the kaleidoscope awakens a fascination in young and old alike that defies easy explanation. Perhaps the appeal is as simple as the observation made in *Antiques* magazine in 1935 that such objects play off "that ungovernable urge of curiosity which prompts the average human being to glue an eye to a knothole in a fence, or to any other small aperture that penetrates concealing barriers." Certainly its spell is as intricate and complex as the meditative mandalas, endlessly changing, created as the viewer turns the kaleidoscope. It touches chords of the unconscious, archetypes that Carl G. Jung believed transcend civilization and culture. By its sheer impracticality, the kaleidoscope bypasses the mundane and worrisome routines of life; it pleases everyone except perhaps the crustiest pragmatist.

Each new generation rediscovers the kaleidoscope's wonders and grows up with fond memories. "I can't tell you how many people have told me they remember getting a kaleidoscope when they had the measles," says Carolyn Bennett (p. 103), a 32-year-old former painter and art teacher who makes her living handcrafting kaleidoscopes in Media, Pennsylvania, near Philadelphia. She is part of a scattered but burgeoning group of kaleidoscope makers whose artful designs aim to please the more sophisticated and demanding adult eye.

Sir David Brewster, who invented the kaleidoscope in 1816, would have been tickled to learn that his little device that once was all the rage is now bouncing back (pp. 100-01). Brewster is the touchstone, the first and most comprehensive authority for kaleidoscope connoisseurs. Brewster described a microscopic kaleidoscope, a miniature useful as "a female ornament" (Carolyn Bennett recently introduced one). He mentioned a kaleidoscope camera that registers the kalei-

Camera lens that produces kaleidoscopic images makes alarming triangle of artisan Peach Reynolds' eye.

Photographs by Wayne Sorce

Finely stamped brass identifies this as kaleidoscope conceived by the inventor, Scotsman David Brewster.

Designer Craig Musser's collection features antique instruments by Brewster and Charles G. Bush.

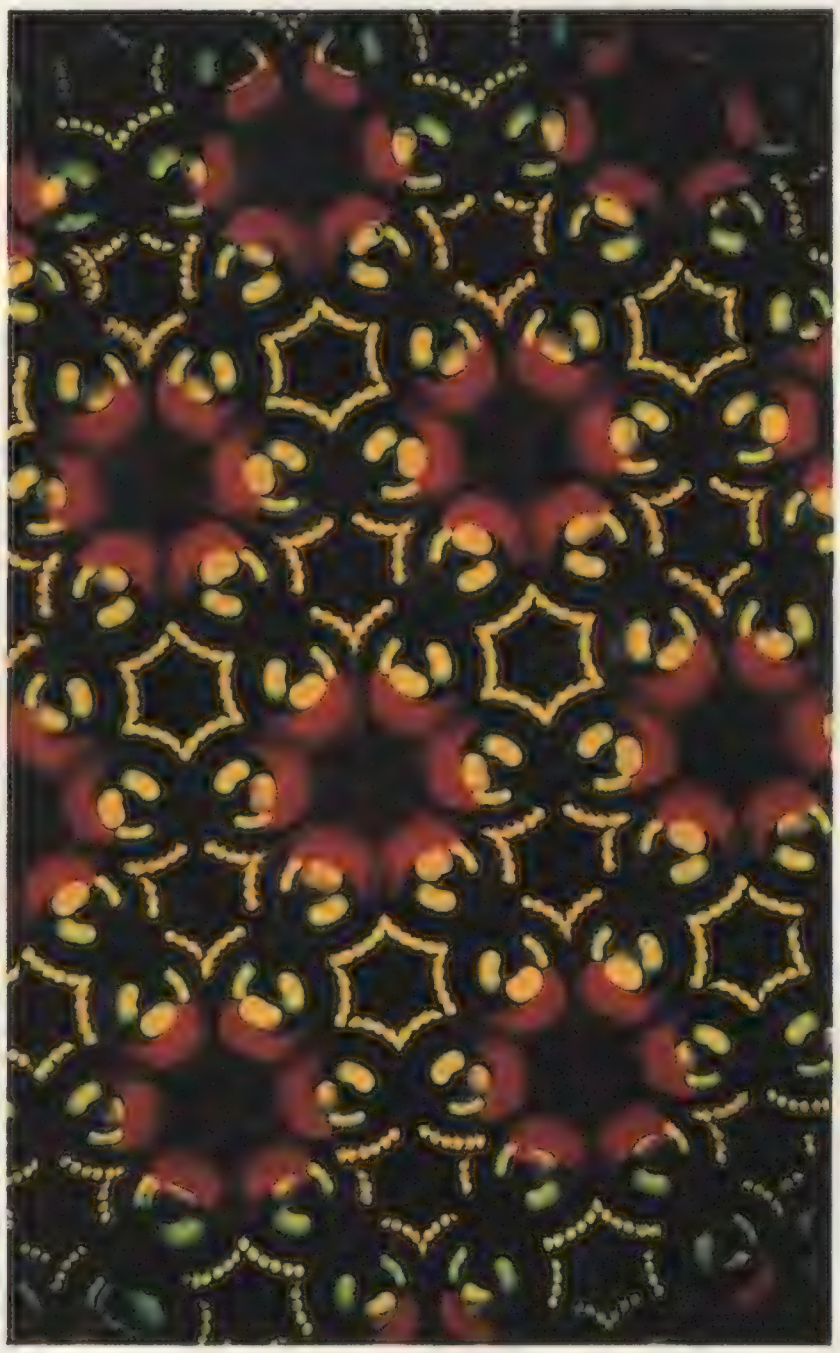
doscope's images. Peach Reynolds, a kaleidoscope artisan in Austin, Texas, makes a device that does roughly the same thing (p. 98). Brewster discusses the telescopic kaleidoscope, or "teleidoscope," a device with a clear lens at the end which turns small portions of the world into kaleidoscopic images. Both Carolyn Bennett and Peach Reynolds make and sell ones that work on this principle.

Brewster was a "natural philosopher," a rough equivalent of today's physicist. He studied a broad sampling of natural phenomena and earned his bread and butter by writing and editing until, at the age of 57, he received a principalship. For most of his prolific career, Brewster turned his mind and penchant for experimentation to the physical properties of light. His questions began as a child in Jedburgh, Scotland, when he built sundials, microscopes and telescopes. They expanded when he entered the University of Edinburgh and started experimenting with light. But Brewster was temporarily sidetracked when he toyed with the idea of entering the Church. Fortified with an honorary M. A. in divinity studies and a license to preach, he found to his dismay (so the story goes) that he suffered from fainting spells whenever he climbed into the pulpit.

In the early 19th century, science was aboil with new ideas about light. The undulatory, or wave theory, was eclipsing the corpuscular, or particle theory. The phenomenon of polarization—in which light, suitably reflected or refracted, exhibits curious effects when again reflected or refracted—intrigued scientists, especially Brewster, who vehemently opposed the un-

A classic image is formed in a Bush kaleidoscope, considered fine example of 19th-century work.

An electronic kaleidoscope devised by Reynolds translates sounds into intricate formations of light.



dulatory theory. He experimented with bouncing light between mirrors, theorizing that after a number of successive reflections the light particles would become more and more polarized. His work with adjoining mirrors formed the backbone of the kaleidoscope. The great leap came when "the idea occurred to me of giving motion to objects, such as pieces of coloured glass, &c. which were either fixed or placed loosely in a cell at the end of the instrument."

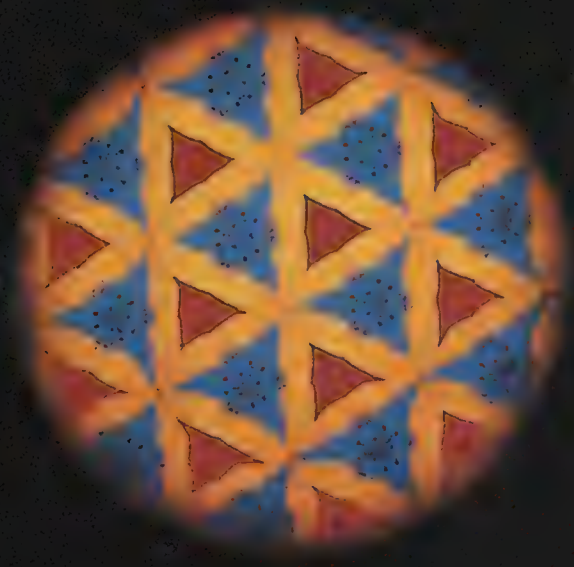
Behold, the kaleidoscope. The Greek roots of the name Brewster chose mirror its purpose: a device to create and exhibit beautiful images. As Brewster relates the tale (and he goes to great lengths to establish his place in history as the originator), the kaleidoscope enjoyed overnight success. Two hundred thousand instruments disappeared from the store shelves in Paris and London within three months. The kaleidoscope also appeared in scientific catalogs, but its place of honor was in the Victorian parlor as a pre-electronic equivalent of television, a dial-an-image pastime enjoyed by all ages.

Brewster's kaleidoscope is as compact as a seaman's spyglass and as informed by specific purpose in its overall design. Housed in a brass, leather-wrapped tube and capped at both ends with knurled brass trimmings, one kind fits snugly in the palm of the hand. The viewer simply rotates the end of the kaleidoscope to tumble the glass pieces. The "object cases"—flat, cir-

Jeanne A. McDermott is a free-lance writer based in New York. A specialist in science and technology, she is making her first appearance in SMITHSONIAN.

Van Dyke image

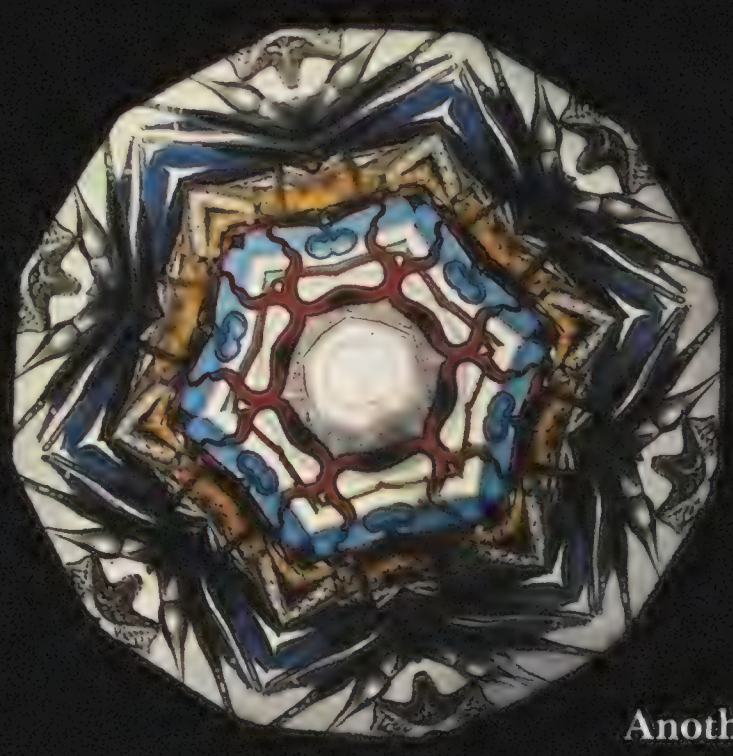
Reynolds Aquascope



A Karelitz Karascope

Bennett variation

Bush classic



Another Van Dyke

cular glass chambers filled with bits of colored or stained glass, pieces of lace, even feathers—are popped in and out of the end like a camera lens. Brewster counsels the viewer to place a live insect in an empty case and enjoy viewing it kaleidoscopically. He loved the kaleidoscope's evanescent and endlessly changing images: "When it [a figure] is once lost, centuries may elapse before the same combination returns."

Useful purposes were served as well

While the kaleidoscope enlivened countless social gatherings, it succeeded less spectacularly in fulfilling Brewster's prophecy that "it would prove of the highest service in all the ornamental arts." For any job involving symmetrical patterns—the design of architectural ornaments, circular Gothic windows, ceiling moldings, carpets, jewelry—Brewster felt the kaleidoscope could be as indispensable as an easel. It never reached that stature, although it certainly was used by craftsmen even into the early part of the 20th century. According to a letter in the collections of the Smithsonian's Cooper-Hewitt Museum of decorative arts and design in New York City, the artists at a print works were basing new carpet designs on kaleidoscope images in 1919. "The man [artist] would look into it while turning and stop whenever he saw a design he thought would suit, which he would copy in water-colors. There were half a dozen men in a room doing this and each would probably make two designs a day, which were all sent to a head man to select from."

Unlike telescopes from the same era, not many 19th-century kaleidoscopes seem to have survived. Their relative rarity may testify to their favored status and repeated use. But Carolyn Bennett traces their dearth in part to that unquenchable desire to learn the magician's tricks. "The kaleidoscope is a very mysterious thing that you don't really understand until you take it apart. My theory is that a lot of old kaleidoscopes got reduced to piles of junk."

Those who have tinkered with one discover that the tricks of the kaleidoscope are, like magic acts, done with mirrors. If you dissect a dime-store variety, you will find a bent piece of reflective metal, forming two mirrored surfaces in a V-shaped trough. If you place your eye at one end and an object such as a pencil directly in front of the other end, you will see a kaleidoscopic image of the pencil. In simple terms, you are seeing one image that is in reality the pencil, two other images that are direct reflections of the pencil and several other images that are reflections of the reflections. The smaller the angle between the two reflecting surfaces, the more reflections and more complex the image. The wider the angle, the fewer reflections and the simpler the image. From this gen-

Judith Karelitz relaxes at home in New York with a sculpture that reflects her work with kaleidoscopes.

Carolyn Bennett puts some colorful touches on a tube in her Media, Pennsylvania, workshop.

eral starting point, the kaleidoscope crafter adds an object case with colored-glass pieces to create a varied and beautiful image, a cylindrical outer covering and perhaps a lens.

The cardboard and plastic beneficiaries of mass production are good fun, but suffer in comparison with quality instruments such as the Bush kaleidoscope, a classic American kaleidoscope patented by Charles G. Bush of Boston in the early 1870s. Apparently his model was extremely popular, for several have found their way into the Cooper-Hewitt and the lives of modern kaleidoscope makers. A large-barreled kaleidoscope, a typical Bush is secured on a wooden pedestal. Multicolored hand-blown pieces of glass, chosen with an eye to complementary textures and

Viewer at center gets double view by looking through two Peach Reynolds Oil Suspension Kaleidoscopes.

movements, give it an inner realm that some find richer than any others of the 19th century.

One of the most lasting impressions made by the Bush was on Craig Musser (p. 106), a former advertising executive in New York. Long fascinated by Victorian antiquities and mandalas (he studied Sanskrit at Harvard), Musser fell in love with a Bush that belonged to a friend. He bought it, took it apart and began his search for others. Out of his genuine fondness for the design, he decided to build a replica. "I was working on an edition of eight after work and on the weekends while I was still at the advertising agency. At that time, I didn't think I could make a 'scope any better than Bush's." That assessment changed as he continued to work on his kaleidoscopes with Bill O'Connor (p. 106), a master glassblower from North Haven, Connecticut.

O'Connor, who is now a partner with Musser in Van Dyke, Limited, the company that markets their Victorian-inspired kaleidoscope, shares Musser's penchant for collecting and eye for perfection. He explains, "I knew what a kaleidoscope was but I had never seen one so beautiful. Craig showed me the parts he wanted me to make, but in the process of working with the glass, I came up with some new ideas. We started off building a replica but very quickly began to refine it into something completely different."

Concentrating on the image

While the Victorians seemed to pay more attention to the outward appearance of the kaleidoscope than to its inner visions, Musser and O'Connor took the other tack. They wanted a spectacular and sparkling image, one whose siren song lured the viewer back, one "so beautiful," as O'Connor's neighbor explained after gazing into their kaleidoscope for half an hour, "that it hurts to look anymore."

It took one year of experimentation and another year to complete the lampworking of the 30 to 40 pieces required for each of the 50 kaleidoscopes in the second edition (like prints and other artworks, kaleidoscopes have been issued in editions). "We strove for colors of gems, pure and rich, and paid particular attention to the shapes. We wanted minaretlike pieces that really looked Arabian," explains Musser. These hair-thin ampules (p. 108) contain glass, finely crushed pieces of coral, pulverized shells, and sand intermixed with mineral oil so that as the viewer tumbles the pieces, the shimmering particle-laden fluid rises and falls. Musser and O'Connor have choreographed a kaleidoscopic ballet not only with the minarets but with crystalline shards, tightly wound twists, helices, shepherds' crooks and horses' manes as well.

"When I was little, I would go to my mother's

South Shore Conservatory, Hingham, Mass. Shot with a 48-86 zoom lens, at f/5.6 at 1/125 sec

© Eastman Kodak Compay, 1982

The less you can count on light, the more you need Kodacolor 400 film.

America's Storyteller

Besides being a collector, Craig Musser distributes the Victorian-inspired Van Dyke Kaleidoscope.

Bill O'Connor holds glass rods, from which new decorative shapes for object case will be fabricated.

friend Marian's house and play with her antique kaleidoscope. That's how I got inspired," says Judith Karelitz (p. 103), a New York artist who works with polarized light and published an edition of 100 polarized-light kaleidoscopes in 1971. If the Van Dyke Kaleidoscope improves on tradition, the Karelitz Kaleidoscope is all 20th century. Made from transparent Plexiglas, polarizing filters, doubly-refracting materials and mineral oil, it stands at the opposite end of the spectrum. But, like Musser and O'Connor, Judith Karelitz has added another dimension with a sensibility that views the kaleidoscope as yet another artistic medium, like sculpture. Constructed from a clear Plexiglas cylinder with a red reflecting Plexiglas triangular prism instead of mirrors, the kaleidoscope's exterior is as revealing as a window-walled skyscraper. The eye focuses on an object case where paper-thin designs made from clear, colorless, doubly-refracting materials are suspended in mineral oil. The rotating eyepiece enables the viewer to change the colors of the image without changing the design. With these industrial materials, a luminous and watery world is created, a dreamy state of muted colors and soft-edged shapes. Like fast-moving clouds, the shapes drift and float into one another only to emerge later in what looks like a different plane.

The Karascope: variation on a theme

Judith Karelitz was a pioneer in the new world of kaleidoscopes, a vantage point from which she has witnessed the recent resurgence. When she began in the early '70s, she sensed that she was exploring in a vacuum, although, she says, "I have a feeling that among the sculptors of the world, many have once made a kaleidoscope." She has also designed a unique and inexpensive kaleidoscope-inspired device called the Karascope. Based on many of the same polarized-light principles of her other work, the Karascope lacks the traditional kaleidoscope's symmetry, and the image instead seems to spiral toward the viewer's eye. Through arrangements with New York's Museum of Modern Art and the Smithsonian Institution, different versions of the Karascope are on sale across the country. Other kaleidoscope-type devices have joined it on the store shelves, including two by artists Ernest Trova and Ed Baynard. For Judith Karelitz, who is delighted with the many thousands that have been sold, this miniboom is as curious as the prospect that anyone can make a living by hand-crafting a kaleidoscope.

A handful, probably no more than 25 people sprinkled from coast to coast, derive much, if not all, of their income from kaleidoscopes. The reality jolts even those who do it. "You know when they asked you what you want to be when you grow up? I *never*

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BAILEYS. TASTE THE MAGIC.

thought I'd say kaleidoscope maker," laughs Carolyn Bennett, who has paid her bills for the past five years by selling at crafts fairs and to shops.

Anyone who makes ends meet as a kaleidoscope maker owes his or her livelihood to the crafts movement. Spawned in the '60s by a sensibility that rejected the anomie and anonymity of mass production, and carried through the '70s by people who embraced its simple and wholesome lifestyle, the movement encompasses artisans who are resurrecting traditional crafts. Although it is dangerous to generalize about a group as iconoclastic as kaleidoscope makers, many are woodworkers and stained-glass artists who gravitated to the device's fantastical qualities.

What began as a loosely organized grass-roots movement, with Saturday fairs on the local town common, now borders on big business—total receipts at one of America's largest annual craft shows, held in rural Rhinebeck, New York, were estimated at $4.5 million last year. Dorothy Marshall, a kaleidoscope maker in Eugene, Oregon, who got started in the early '70s, laments the trend. "The crafts movement is getting integrated and mainstreamed. Just like the Bauhaus." She fears that this brand of growth will crimp creativity, producing more variations and fewer new themes. But Eric Sinizer, owner of the Light Opera, a specialty shop in San Francisco, believes that it will expand the universe of kaleidoscope connoisseurs.

If history repeats itself with greater frequency than the kaleidoscope's inner images and the toys make a comeback, Peach Reynolds has a few surprises in store for those who think only of the throwaway models of their youth. Reynolds, who launched his business nearly nine years ago before graduating from the University of Texas in Austin with a degree in philosophy, is the first to admit that he "didn't get into 'scopes for the art." He elaborates, "If I hadn't developed a technique for selling them—and nothing is as easy as selling kaleidoscopes—I'm sure I'd be selling used cars." But in fact Reynolds' regularly updated line of kaleidoscopes—from the old-fashioned model with stained glass, beads and buttons to one with multicolored oils or another with seashells—is handsome and inventive. For the '80s, his newest style will go high tech. "We're looking at fiber optics, sound-activated electronic lights," he says with delight. "We're looking at the space-age kaleidoscope." Sir David Brewster would have approved.

Object case in O'Connor's hand holds liquid-filled ampules and other glass creations for a kaleidoscope.

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By John G. Mitchell

Our wily white-tailed deer: elegant but perplexing neighbors

They are the embodiments of wild grace, but their numbers have grown dramatically and in some areas they have become pests

Consider *Odocoileus virginianus,* the white-tailed deer. No other large mammal in America is so widely distributed, so devoutly admired, so eagerly sought in the hunt, so zealously protected, so destructive of overstocked range, so influential on the perceptions of those who value wildlife for whatever reasons, consumptive or otherwise. The whitetail is a creature of superlatives. Half a century ago, as the species began to bounce back from a long bout of slaughter and habitat deprivation, the naturalist Ernest Thompson Seton proclaimed it to be "the swiftest, keenest, shyest, wisest, most prolific, and most successful of our Deer. . . . The whitetail is the American Deer of the past, and the American Deer of the future." Time has only strengthened that judgment, though Westerners attuned to the mule deer, and Pacific-coast dwellers partial to blacktails, may heartily disagree.

For my own part, I am torn by ambivalence when it comes to the white-tailed deer. Walt Disney got to me early. I wept for Bambi when the huntsmen slew its mama; yet today I count deerslayers among my closest friends, and understand what drives them to it and bear no grudge and, in fact, occasionally join them afield, bearing arms. But I have never shot a deer, or *at* one. Perhaps someday I will. Perhaps I won't. For now, it is enough to watch them in the amber light of dawn, high-stepping through the ferns and the acorn oaks to the hideaway swamp. The woods I know—of Michigan and New York, of Connecticut and New Hampshire—would lose a lot of meaning for me if the whitetail should ever step away from them for keeps. No more the startled snort and stamping hoof, the white flag waving, the scat on the trail, the tracks in the snow? "I find it kind of lonesome," an Ontario trapper told me once, "to be in the bush—without deer." And so do I. But lately I've been wishing deer would stay in the bush, where I need them. Where I don't, in the garden, they're a plague.

This Michigan buck's antlers are encased in velvet, a hairy skin that nourishes them as they grow.

Taxonomically, the whitetail is of the order Artiodactyla, the suborder Ruminantia, and the family Cervidae, of which there are some 40 other species, including elk, moose and caribou. Cervidae of one kind or another are native throughout the Americas, Asia and Europe, but not in Africa south of the Sahara (where antelope species hold sway), or in Australia and New Zealand.

In the Western Hemisphere, the whitetail's range cuts far and wide—from Nova Scotia to British Columbia, and south to the nearer shores of the Amazon River. Except for Alaska, Hawaii and possibly Utah, it is found in every one of the United States, though habitat factors tend to segregate it from the mule deer in western states where the species overlap. Taxonomists recognize 38 subspecies, ranging from the large *Odocoileus virginianus borealis* of the northern woodlands to the diminutive *O. v. cariacou* of tropical Brazil. So how did Virginia, rather than Maine or Brazil, gets its name on the whitetail? Apparently because one Thomas Hariot, in the service of Sir Walter Raleigh, reported seeing "great store" of "deare" in that colony in 1584. Thus it became the Virginia whitetail, much to the continuing consternation of us Yankee folks, who know better.

Like most large mammals, the whitetail can be an unpredictable creature, especially during the rut, or mating season, and in captivity. Deer literature is replete with accounts that belie the animal's natural shyness—accounts of woodsmen gored by flashing ant-

The wily, perplexing whitetail

A buck browses on pine; branches within deer's reach are bare, perhaps indicating an overpopulated area.

lers, of hunters slashed by flailing hooves (and without provocation, according to one biased witness). Seton wrote of a grandmother "trampled to rags" in an Ontario orchard by a tame deer "she had fed a hundred times." And until quite recently, one or another of the hook-and-bullet periodicals would annually feature the apocryphal tale of some "rogue" buck (the rogue, I suspect, serving as antidote to Bambi). No matter. We all have this way of inflating what we most admire. Even the unsensational Henry David Thoreau succumbed to temptation. In *The Maine Woods*, he wrote of a deer that ran into Bangor, "jumped through a window of costly plate glass, and then into a mirror, where it thought it recognized one of its kind." Bangor folks, wrote Thoreau, thereafter called it "the deer that went a-shopping."

As for commonplace whitetail facts, one might as well begin with the rut—November most places, or later elsewhere, depending on climate and nutrition. The gestation period runs some 200 days. In the North, male fawns weigh about seven pounds at birth, nearly 30 by the end of their first month. At maturity, a northern buck on good feed may weigh more than 200 pounds (does are about 40 percent lighter), but a Florida Key deer, male, may scale out at no more than 50 pounds.

Hunger for everything from corn to poison ivy

Though the whitetail will feed upon grasses, grazing is not its habitual way. Most places, it prefers to browse the woody plants, taking the leaf stems and buds. In the fall, in oak country, it will forage for acorns; in winter it turns to the conifers, and nibbles at forbs in the spring. White cedar and aspen are major foods in some of the northern states; greenbrier, sumac and sassafras, southern. In Pennsylvania, researchers found in one controlled environment that whitetail tastes favor dogwood, maple and birch over red oak and hickory. In Ohio, rumen examinations and field observations showed a whitetail preference, in decreasing order of importance, for wild crab apple, corn, sumac, honeysuckle, clover, soybeans and jewelweed, among other plant species. More than 600 such species are known to be eaten by white-tailed deer, nationwide. Mushrooms and poison ivy are among them.

One of the more fascinating commonplace facts about the whitetail is its biannual change of color. Summer, when deer come "into the red," as the saying goes, scant reddish-brown hairs replace the winter coat. Fall, deer come back "into the blue," though less than blue, with a thick pelage of hollow, grayish-tan hairs that provide good insulation, such that a whitetail may lie down in the snow without thawing the cushion beneath it. It is altogether a finely tuned crea-

A whitetail strolls through yard in author's hometown in Connecticut, where deer often dine in gardens.

ture, this American deer of the future. And of the past.

They came out of the Northwest, over the land bridge from Asia; not whitetails yet, but some ancestral Miocene breed that would spill out over time and distance, adapting slowly to the challenges of the New World. By the time two-legged spear hunters began to replace saber-toothed cats among the species' top predators, American deer in all likelihood had evolved into the swift and cagey creatures we know today, black-tailed toward the sundown, white-tailed toward the dawn.

In the East, woodland Indians were clever manipulators of the deer. It might be said they invented the practice of wildlife management long before European sailcloth brushed the piney shores of Virginia and Cape Cod. All around the aboriginal villages of tidewater New England, early pale-skinned rovers encountered large tracts of burned-over land, put to the torch not so much to make clearings for crops as to stimulate browse for the whitetail. "The savages . . . set fire of the country . . . because it would otherwise be so overgrown with underweeds," a visitor to New England wrote in 1632. They also wanted berries and venison.

As settlers pushed west across the Appalachians, their axes carved pathway clearings in the forest, and at the edge of each clearing the sun brought forth browse. What may once have been marginal habitat for deer soon became prime country for whitetails. And for a while the animals multiplied, even as they supplied the frontiersman with protein for his belly and buckskin for his back.

Subsistence in time gave way to commerce. Hides by the thousands were shipped to England. In 1784, when folks in what is now Tennessee began talking of creating a new state called "Franklin," someone came up with a bright idea for compensating the governor. For wages he would receive 1,000 deerskins.

There was a market for meat as well as hides. By the end of the Civil War, venison was going for the outrageous price of a few cents a pound. Upwards of five million pounds moved over the counters of Michigan in 1880 alone. Meanwhile, in the Northeast, men of leisure were turning to the great outdoors. Out of the posh Maine camps and Adirondack hotels they poured, armed not for subsistence or commerce, but for sport. Some sports thought nothing of shooting a hundred deer in a single summer.

The herds went fast. By the early years of this century, unrestricted hunting and loss of habitat to agri-

John Mitchell wrote on the return of the buffalo in the May 1981 SMITHSONIAN. *He is author of* The Hunt.

Whitetails feed in a Texas clearing. In southern states the deer are more often found in small herds.

culture—wall-to-wall fields, and no edge—had eliminated the whitetail from Iowa, Illinois, Indiana, Ohio and southern Michigan. Ernest Seton had guessed that 40 million deer had ranged eastern and mid-America in presettlement times. In 1927, his guess was that whitetails were "practically absent" from all the aforementioned states, plus Nebraska and Kansas, northern Missouri, Kentucky, southern Wisconsin and Minnesota, and much of New York. Once, in Missouri, I met a countryman who was born on the edge of the Ozarks about 1929, spent all his growing-up time exploring the fields and woods, and never saw a deer track—"until Nineteen-and-forty-seven," he explained. "I couldn't believe my eyes. So I dug all around it, lifted it like it was a cast, and took it on home. I needed the proof," he went on. "It was so bad then."

It could have been worse, for even as urbanization and industrial farming continued to chew up the whitetail's range, new and improved deer habitat was appearing across the logged-over forest lands of the north country and in marginal fallow fields abandoned by men wiped out by the Depression. There was another mitigating influence, and that was the advent of conservation as a strong political force in American society. Suddenly state governments were imposing bag limits and short seasons (or no season at all), with full protection for does and fawns. And into many regions from which the deer had been extirpated, wildlife managers imported captive stock, then released them to the wild. Ohio, where the last wild deer disappeared in 1904, started restocking in 1922. Ten years later, a thousand whitetails were released from pens into the hills of Scioto County, while footloose wild ones wandered in from western Pennsylvania. By 1965, the statewide deer population was put at 17,000. By 1980, that herd had increased sixfold.

In some whitetail precincts, however, more deer inevitably led to too many deer, and then to winter starvation, and then to almost no deer at all. Deprived of almost all their natural predators save Man—largely through control programs and bounties on such herd-thinners as the wolf—and reproducing prolifically after decades of "buck-only" game laws, some born-again herds were already hitting the skids by the 1940s. Aldo Leopold, the ecological philosopher (SMITHSONIAN, October 1980), wrote of having seen "state after state ex-

tirpate its wolves. I have watched the face of many a newly wolfless mountain, and seen the south-facing slopes wrinkle with a maze of new deer trails. . . . I have seen every edible tree defoliated to the height of a saddlehorn. . . . In the end the starved bones of the hoped-for deer herd, dead of its own too-much, bleach with the bones of dead sage, or molder under the high-lined junipers." Leopold was writing of the western mule deer. But it might as well have been the whitetail, for almost every year that wind chill and deep snow besiege the wolfless deer yards of the northern woods, more than two million of the animals die of malnutrition and starvation—their own too-much.

In July, 5,500 whitetails were found starving in the Florida Everglades when flooding left them stranded on barren islets without food. The Florida Game and Fresh Water Fish Commission tried to thin the deer so those remaining would have a chance to survive. The area was divided into two sections—north and south of Alligator Alley—with the intention of permitting a two-day hunt in each. Legal delays forced the Commission to abandon plans for a hunt in the north but, in the south, the hunt was conducted. Meanwhile, animal protection groups protested the killing, and attempted to airlift animals out of the north swamp (18 were saved, eight of which have since died). In the south, where hunters slew 723 deer, the survival rate was much higher than in the north.

Few deer anywhere die of old age; in some precincts, the life expectancy for males is less than three years. What the hunter misses, the winter gets. What the winter misses is soon brought down by something else. Predation by domestic and feral dogs is a serious mortality factor in some states. From time to time, internal parasites and viral diseases take a certain toll. In farm country, wire fences can be grim reapers, too. Whitetails are spectacular running broad jumpers. But now and then they miss, become entangled and die in the wire or from injuries sustained extricating themselves. By one estimate, five of every 100 deer may ultimately die in such a fashion.

And then there is the highway and the automobile. The slaughter here may be second only to hunting in some states, some years. In 1980, Pennsylvania counted 26,000 road kills. On one eight-mile stretch of Interstate 80, near Snow Shoe, Pennsylvania, researchers reported 286 kills in a little more than a year's time. Most of the deer were hit while crossing the pavement to feed on forbs in the median strip. Sunrise and the hours after sunset are the critical times for such accidents. One recent study of deer-vehicle collisions in Michigan found that, after the accident, one out of four of the autos has to be towed away for repairs. Few drivers are injured. Almost all of the deer are killed.

The amount of property damage—to farms and forests as well as to cars—that might be attributed to the white-tailed deer is incalculable. Grain farmers, orchardists and nursery operators whose lands coincide with the ranges of top-heavy herds generally suffer the greatest damage. Apple orchards are especially vulnerable. In the mid-Hudson Valley area of New York, 86 fruit growers reported an average of $3,000 in deer damage for 1980. Deer cannot resist the terminal buds on the trees, not to mention the apples.

Even more incalculable is the damage occurring in the gardens and backyards of exurban America. To the whitetail, it is the old frontier all over again—all these clearings in the forest with their sunlit edges of succulent plants. In some settled areas where hunting pressure is scant, deer soon lose their fear of the human presence and begin to move out from the edge, nibbling whatever strikes their fancy right up to the planter boxes beside the back door. "It's a growing problem, all right," says Robert Donohoe, a deer biologist with the Ohio Division of Wildlife. "People from the city go out to the country to build their dream

In West Virginia field, wary yearling buck looks and listens. Sight, hearing and sense of smell are acute.

house. And then just when all the new shrubs are in place, they suddenly discover they're living in the middle of a whitetail kitchen."

It occurs to me that I may be living in the middle of a whitetail kitchen. I do not say so with pride. It is a confession soured by sorrow for all that I lost to the critters last winter, and puzzlement as to what I shall do to cut further losses in the cold months ahead. I live in a Connecticut hill town only 65 miles from the heart of Manhattan. It is a town with such a surfeit of whitetails that some of my harried, nonhunting neighbors are beginning to speak of a right to bear arms. One writes to a friend in Alaska: *Send more wolves!*

Our town is peculiarly well suited for the care and feeding of white-tailed deer. Of its 20,000 acres, nearly half remain undeveloped—a few old fields succeeding to red cedar here and there, but mostly the kind of mixed hardwood forest that dishes up acorns and hickory nuts and many of the other good things that deer like to eat. Much of the land is protected as open space by a regional water-supply company, the town's conservation commission, a private land trust, and by such other wildlife protectors as Nature Conservancy and the state's Office of Parks. As for the human population, some 7,000, it is scattered for the most part in vintage homesites and large-lot subdivisions tucked away in the woods. Some newcomers from the city complain that they cannot see their neighbors for all the trees. But no one complains about not seeing deer. There is so much of that succulent edge.

The spring before last, wanting for evergreens around my place, I planted four hemlocks, three arborvitaes, and a Douglas fir, all fairly close to the house. They survived the droughty summer, showed vigor in the fall, then proceeded to provide a bright touch of color under winter's bleak skies. It snowed. There were deer tracks in the snow. The tracks led

This three-week-old fawn could have been a model for Bambi; it will lose its spots at about three months.

Winter can mean disease, malnutrition for whitetails. Each year two million die in the northern states.

Thirteen million deer hunters take to the field each autumn; they kill about two million whitetails.

from the edge of the woods to my evergreens. Where there had been needles and twigs on the arborvitaes, now there were stubs.

I consulted an expert. He said that dried lion's blood was an excellent whitetail repellent but, alas, hard to come by. So he suggested human hair, bundled up in the toes of discarded pantyhose, then hung from a branch of each threatened tree. Armed with sweepings from a barbershop floor, I established a defensive perimeter. It was breached overnight. Stubs on the fir. Skeletons for hemlocks. I have a friend in Tanzania. *Send more lions!*

The mayor of our town, or First Selectman as they are called in the hamlets of Connecticut, is a dedicated environmentalist by the name of Mary Anne Guitar. A cofounder of the land trust and a former member of the conservation commission, she had devoted much of her time in the '60s and '70s helping to acquire and protect many of the large open-space tracts that now serve as sanctuaries for the white-tailed deer. Having barely exchanged one official hat for the next, the new Selectman found herself assailed by constituents demanding relief from the deer. One of the strongest complaints came from the resident state trooper, who cited deer-vehicle collisions resulting in fatal heart attacks, permanent eye damage, and one police cruiser towed for repairs from the scene of the accident. "The town is becoming overrun with deer," said the trooper in his memo to the mayor, "and they now pose a serious threat to life and property."

Someone suggested opening the town's sanctuaries to hunters. The state's deer biologist in Hartford disagreed. He figured the seven to 20 deer that might thereby be harvested would hardly be worth "the public relations problems you will face by sanctioning such a venture. . . . There are more persons who want deer," he went on, "than those who don't."

One answer: the Wall

One fine summer day I went out past my gaunt relict conifers and drove across town to the home of Mary Anne Guitar. It was a Saturday. She was working in her garden. I was admitted to the premises through a gate in an eight-foot-high wire fence. The Wall, she calls it; her personal solution to the deer problem. We walked past beds of delphiniums and roses to her vegetable patch enclosed in chicken wire, a wall within the Wall. And we talked about saving open space and fending off deer.

"The more I did for those deer," she said, "the less they appreciated it. They came in here and ate my perennials. That's when I got anthropomorphic and decided that plants have rights, too." She paused then and gazed admiringly at the horizontal wires that

Two bucks and a fawn show thick winter coats.
Bucks have shed velvet and antlers are in "hardrack."

traced the top of the Wall. "Deer are ungrateful," she said. "What else can I tell you?"

And now it is that certain time of year again—the blaze-orange season of the hunt. Across these United States, 13 million hunters are rolling out to the call of Opening Day, but fewer than one in six will, by the end of the season, come home with a deer. Despite such dreadful odds, and despite the disapproval of those who perceive the hunt as both cruel and archaic, there seems to be no attrition at all from the ranks of the deer hunters. In America, almost as many people hunt deer as play golf. It is not a small economic matter, this business of killing deer. Figuring amortized costs of equipment and expenses for travel and lodging, deer hunters this season will probably spend upwards of $2.5 billion. Venison does not come quite so cheap nowadays.

Still, hopes for individual success this year are running high, for last year's harvest was a whopper in most of the major whitetail states. Texans retained their national title as champion deerslayers by dropping some 300,000 head. In the number-two state, Pennsylvania, the calculated harvest was 225,000 or more. Michigan again took third place with 210,000 reported kills, an all-time high; and New York set a record itself with more than 165,000. And yet, for all the killing and winter losses over the past five years in the snowbelt states, some managers are reporting whitetail numbers that remain out of balance with the carrying capacity of the land. "In parts of the Northeast," says William T. Hesselton, a research specialist with the U.S. Fish and Wildlife Service, "the habitat can't support the population much longer. In general, we have deer coming out of our ears."

Part of the present problem may be rooted in a hunting tradition from the past. Across the length and breadth of whitetail country, lecturing sternly from their cracker barrels and rocking chairs, there presides a generation of white-haired hunters who still believe that the only way to have deer is to take the bucks only, and spare all the does. After all, wasn't it the buck law that brought the herd back? And isn't it common sense that if you take away the buck law .... The sons and grandsons gather 'round and listen. Shoot a deer without antlers? They would rather be caught dead. So the antlerless permits and seasons come and go, protested in some places, boycotted in others where conventional wisdom holds the doe as sacred as motherhood and the star-spangled flag.

It gets to be that way in certain Texan places, especially in the several counties where road commissioners, instead of game commissioners, have the last say on deer. I heard this story from a wildlife biologist out of Austin. Down to a rural county courthouse he went one day to make a plea for an antlerless hunt. The herd, he explained, was eating itself out of house and home, and culling of does was in order to bring things into balance. Before he could finish, one of the road commissioners rolled up his sleeves and invited the biologist to step outside to the courthouse plaza. "We'll settle this nonsense out there," said the countryman. "The gentlemanly way."

The whitetail does that sort of thing to all of us, one way or another. It curdles our emotions. It befuddles the brain. Its elegant presence convinces some folks that humankind is wrong to hunt; convinces others that the greater wrong would be to hunt not at all. Who knows? What worries me, as I gaze out the window and look beyond my whittled evergreens at the dark forest edge, is—how *do* we keep the balance? Like the man in Hartford was saying: there are more people who want deer than those who don't.

Bounding deer says goodbye with flash of white undertail that gives the species its name.

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THE GOLD CARD®

By Janet L. Hopson

They're harvesting a new cash crop in California hills

Disputed 1978 law requires utilities to buy energy from private producers at top prices, inviting entrepreneurs to harness the wind

There is a giant crop standing in rows on the wind-swept hills of Jess Ranch. It is not the wheat or barley one can see from the freeway, an hour's drive east of San Francisco, nor the native scrub oaks, thistles or ubiquitous golden grass. Rancher Joe Jess has 600 acres of rangeland dotted with tall white wind machines that tower over his Herefords and produce a new cash crop: electricity. The wind farm at Jess Ranch is part of a young energy endeavor beset with financial and technical difficulties. But, with any luck, the slightly rickety wind-power industry—complete with crazy contraptions, earnest inventors and lofty megawatt turbines—may soon take off.

Jess Ranch sits squarely astride Altamont Pass, a zone of dry, grassy hills east of the Coast Range surrounding San Francisco Bay, and west of California's vast Central Valley. Eight months of the year, the temperature difference between the cool coast and the hot valley is so great that a powerful pressure difference is created and air surges inland, funneled through natural gaps like the Altamont. The annual average wind speed amounts to 17 miles per hour, including the four calm winter months.

"Nobody ever wanted to live out here in the wind," says Jess, a good-natured, 43-year-old family man who wears a Stetson—tight, so it won't blow off. "It's hard on the cattle. And it's hard on your nerves. I've been cussing this wind for over 20 years. But now," he adds with a chuckle, "it bothers me when it don't blow!"

The Altamont area has been called the "epitome of marginal land." Its grazing value is about $10 per acre. Now, though, wind-energy entrepreneurs are rushing to lease "wind rights" on acreage all over the Altamont. Suddenly, one can hear phrases like "watts per square mile" and figures such as annual electric potentials of $20,000 per acre. Jess neatly sums up his view on this new proposition: "It's sure going to beat the cow business!" But he will keep his Herefords, too: the wind machines do not seem to bother them. In fact, the cows use them as back scratchers.

Joe Jess has leased access-and-wind rights for most of his 600 acres to the Fayette Manufacturing Corporation, a small wind-energy firm run by John Eckland. An economist and trained engineer, the 40-year-old Eckland (p.124) grew up on a walnut farm in nearby Stockton. But he has spent most of the past decade in Washington, D.C., as chief of energy research for the Central Intelligence Agency. In the midst of generating reports on the uncertain future of our nation's oil supply, Eckland became a strong advocate of renewable energy sources. Eventually, he left the CIA to start his own wind-energy firm. He bought Fayette Manufacturing from a Pennsylvania inventor who had tinkered with wind turbines in his basement. All the wind machines spinning on Jess Ranch were designed and built by Fayette.

Top dollar for independent producers

Early this year, there were 44 of the 56-kilowatt machines standing in orderly rows—a mechanical "crop" capable of producing power for 400 families. When the wind farm is complete, there will be several hundred machines, producing perhaps 30 million kilowatt hours per year—the power used by 4,800 homes. The local utility, Pacific Gas & Electric, purchases the power for a rate equivalent to the cost of producing electricity from its most expensive fuel. Under a 1978 Congressional act, utilities were required to buy power from private producers at this high, "avoided cost." The glass-covered electric meters connected to each wind machine tabulate kilowatt hours—just like the ones on millions of houses across the country. But at the end of the month, Fayette Manufacturing gets a check, rather than a bill, from the utility.

Modern wind turbines are not so different in principle from the windmills that crushed corn in ancient Persia, pumped wells in China, ground wheat into flour in medieval England, or drained the Zuider Zee. Dutch and English settlers brought to 17th-century

Three wind turbines, each capable of producing 56 kilowatts, capture the wind's energy in Altamont Pass.

Selling the wind in California

At a distance, wind farm could be a sculpture garden. Cattle are watched for any effects of turbine howl.

Wind-energy entrepreneur John Eckland adjusts controls for wind generators; meters record output.

America the same wooden windmills that grace Rembrandt's landscapes. Then, just after the Civil War, several U.S. companies patented a type of wind machine that was to become a symbol of the Great Plains: the multibladed, water-pumping "wind motor," perched atop a pointed derrick. About six million of these small pumps appeared on rural farms, and perhaps as many as 150,000 are still whirling and clanking today, filling cattle troughs and tanks.

Windmills that could generate electricity appeared first at the turn of the century in Denmark—a nation with technical know-how but few energy resources. Ironically, rural Americans were content with their water-pumping wind motors until the advent of radio. By 1930, thousands of country residences sported small electricity-producing wind turbines that could run the family radio, a few lights and special 32-volt refrigerators. Eventually, the Rural Electrification Administration brought cheap electricity to farmers and ranchers, and many of the wind machines came down. However, electric wind turbines were to be resurrected more than once.

During World War II, fuel shortages stimulated the development of larger wind turbines, again in Denmark. Even before the war, large wind machines had been envisioned by a farsighted Vermont engineer named Palmer Putnam. During the late 1930s, he designed the biggest wind turbine in the world. With his

aid, the S. Morgan Smith Company of York, Pennsylvania, built a 120-foot-high machine with a 175-foot-wide rotor, which was erected on a bald hill called Grandpa's Knob, overlooking the Champlain Valley. The machine produced 1,250 kilowatts in a stiff wind, despite development problems and the difficulty of obtaining spare parts under wartime conditions, until one eight-ton blade broke loose (in 1945) and the financially pressed firm gave up the wind business.

But not until the environmental worries and oil shortages of the 1970s did a serious effort begin in the United States to develop a wind industry that could produce power for consumers (SMITHSONIAN, November 1973). Government spending for research and development of wind turbines increased, especially under the Carter administration, and Congress passed energy tax credits. All this made wind machines good tax shelters and stimulated serious interest by private investors.

The push toward a wind industry proceeded quickly in two directions: toward small machines, invented and manufactured by private firms like Fayette; and toward large machines, larger than the one on Grandpa's Knob, designed and built by some of America's big industrial corporations, and whose development and testing was supported by the U.S. Departments of Energy and the Interior and the National Air and Space Administration. By now, there are 50 or 60 private companies offering small wind turbines with rotors under 50 feet or so in diameter.

From 1977 to 1981, large machines were erected at sites in New Mexico, Puerto Rico, Rhode Island, Hawaii, Wyoming, North Carolina and Vermont. The builders have been corporate giants such as Boeing, United Technologies, Westinghouse and General Electric. The largest of the government-funded installations is a cluster of three wind machines overlooking the Columbia River in southeastern Washington near Goldendale. Built by Boeing, each is the height of a 20-story building and has a rotor wider than the wingspan of a jumbo jet (p.126). The 2.5-megawatt generators are the precursors of a "third generation" of even larger machines that may have 400- to 420-foot rotors and will generate seven to seven-and-a-half megawatts of electricity. Each of these large wind turbines could save as much as 20,000 barrels of oil annually.

California's Pacific Gas & Electric has just completed the erection of one Boeing MOD-2 at a site north of San Francisco, and many other utilities are considering the possibility of installing large wind turbines. Technical problems and financial uncertainties, however, have as yet prevented the wholesale acceptance of wind energy for power customers. Every new technology has a shakedown period. And the young wind industry, not surprisingly, has already seen some disheartening technical fizzles. One type of large machine resembles a cowboy's spinning lariat; it has three curving blades attached at the top and bottom that rotate on a vertical axis. In the spring of 1981, during a test run in San Gorgonio Pass, near Palm Springs, one of these rotating blades sprang loose and, within seconds, sliced through the supporting guy wires and toppled the entire unit. Another machine in that same windy pass, a three-bladed horizontal-axis turbine, developed such internal hydraulic problems that one report said it died of "high blood pressure."

Small machines have had their share of less spectacular but equally trying problems. John Eckland would occasionally find blades hanging from the Fayette towers "like crumpled birds." As a result, all of the wind turbines at Jess Ranch are being fitted with stronger blades. On another wind farm in the Altamont area, several rotor blades have been launched into flight during routine operations. And late last year, Pennsylvania inventor Terrence Mehrkam was killed while attempting to repair one of his machines operating in a high wind near San Diego.

While such tragedies may be rare, problems are commonplace at the start of any new industry. Wind

Janet L. Hopson has written for SMITHSONIAN *about sea-floor mining, sex pheromones, platypuses and the day-to-day work in a recombinant DNA laboratory.*

Boeing wind turbine in southeast Washington is 20 stories high; rotor is wider than a jumbo-jet wingspan.

power, however, also faces some serious economic challenges. These include the general recession and high interest rates, the temporary glut and drop in oil prices and Reagan administration budget cuts. Since 1980, federal support for wind-energy projects has been cut by more than 90 percent, and many of the large machines may have to be crated and stored unless taken over by utilities.

Perhaps more significant is the administration's current campaign to repeal the business-energy tax credits three years before their expiration date in 1985—a move that could seriously reduce private investment in both large and small machines. More important, a federal appeals court ruled in January that the Federal Energy Regulatory Commission had acted improperly in writing the regulations implementing the 1978 law. The court said the commission had not adequately justified imposing the "full avoided cost" policy and did not have the authority to require utilities to hook up with small producers unless cumbersome procedures were followed. Legislation that would clarify these areas is pending in Congress.

Many observers say that if the wind industry can surmount its current financial and technical hurdles and begin to mass-produce wind machines, costs per unit would drop rapidly. This would make them good investments based on the sales of electricity alone, and not because of their value as tax deductions.

For small firms like Fayette, these early financial and technical challenges present a real survival threat. Eckland has risked his own personal finances on the venture. He and his family are "living like students again," he says, and the field moves and changes so quickly that if he makes a wrong decision or acts too slowly, he "won't be in business next year." Nevertheless, Eckland and many others in the industry are optimistic. "I foresee a day, maybe ten years from now," he predicts, "when the entire Altamont area will be covered with wind machines." Not only does the area have powerful winds, but local utilities have been cooperative, he adds, and California offers its own energy tax credits. Others make similar predictions about the windswept mountain passes outside of San Diego, Los Angeles, Santa Barbara, Monterey; windy areas off the coasts of New England and the Pacific Northwest (islands generally are very good locations for wind turbines); the northern Great Plains; and parts of Wyoming, Colorado, Montana, Hawaii and a few other states.

Two years ago, the National Science Foundation estimated that wind energy could supply from seven to 13 percent of U.S. electricity needs by the year 2000. This would translate into 25-40,000 large multimegawatt wind machines for what might then be a multibillion-dollar industry by the turn of the century.

A few environmental issues have been raised over wind power: noise from the rotors, interference with television reception, blade-and-tower failure and "visual pollution." That last objection puzzles Joe Jess, who thinks wind turbines are "rather pretty, especially when a whole row is spinning around" (pp. 124-25). Nothing about them, he says, bothers his family.

It seems likely, if the wind industry can overcome its start-up problems, that we will see large and small wind farms with increasing frequency. And perhaps, like the windmills of Rembrandt's landscape paintings and the clanking wind motors of the Great Plains, the sleek white wind turbines that are now new technology will someday become 20th-century symbols of North America's windiest places.

Technician climbs tower on an Eckland machine; the rotor forms circle 30 feet in diameter when it turns.

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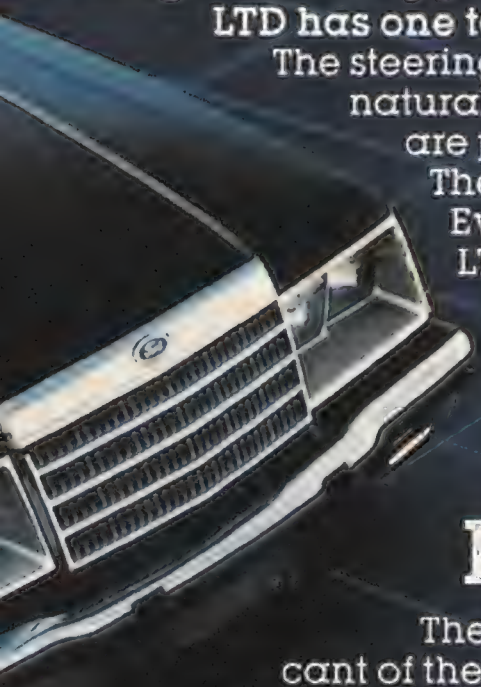

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Louise and Joseph Wissert, Los Angeles

By Frank Getlein

In paint and film they saw a precise image of America

Inventing a new native art, these painters and photographers looked clearly at their country and set it down freshly and forever

Art Museum, University of New Mexico, Albuquerque

Smokestacks intrigued Sheeler. He took many pictures of power plants, this one in River Rouge in 1927.

The idea is simple, natural and clear and it is contained in the name of the show, "Images of America: Precisionist Painting and Modern Photography." It brings together in admirable lucidity the photographs by Americans who created "modern photography" in this country, and paintings by other—in a few cases the same—Americans who created the American art called "Precisionism."

Now on view at the San Francisco Museum of Modern Art (through November 7), the show will travel to the St. Louis Art Museum (December 6-January 30, 1983), the Baltimore Museum of Art (February 28-April 25), the Des Moines Art Center (May 23-July 17) and the Cleveland Museum of Art (August 15-October 9).

In Europe the main line of modern art, which is to say Cubism, began with traditional subjects seen freshly in the manner of Cézanne raised to a higher power: arrangements of fruit, bottles and newspapers, all those guitars, the undraped figure—though "undraped" seems a mild term for figures which often seem not only unfleshed but deboned as well, not to mention sliced and diced. In America, quite the other way, native modern art began with an awakened perception of the building arts of architecture, construction and engineering. In Europe the appearance of such subjects in art was peripheral, both geographically and esthetically—Russian Constructivism, Italian Futurism—and it was more often than not accompanied or preceded by declarations and manifestos of intent. In America, all of it simply happened in the hands of painters and photographers going about their business and being struck, individually, by the previously unnoticed attractiveness as subjects of the new constructions and the new machinery everywhere to be seen. In Europe, then, modern art consisted at the outset of images in the studio rearranged; in America, it was indeed Images of America. And the images were perceived and created more or less simultaneously by painters and photographers.

There were links between the two arts from the very beginning and the links lasted. Alfred Stieglitz, for example, was a pioneer in promoting photography as a form of art along with avant-garde painting and sculpture. He rapidly became and is now remembered as—in gallery terms—the provider of a home place, a pivotal gallery called "291" and the wonderfully named "An American Place," for the painters who turned out to be the Precisionists. And, of course, Stieglitz himself was and remains one of the towering

Charles Sheeler painted and photographed numerous industrial scenes; this is *Fugue*, painted in 1945.

The Regis Collection

Sheldon Memorial Art Gallery, University of Nebraska-Lincoln

Berenice Abbott's *Murray Hill Hotel, Park Avenue at 41st Street* shows her sharp eye for contrasts.

Georgia O'Keeffe's *Shelton Hotel, New York No. 1*, 1926, is one of the city scenes that fascinated her.

artists in American photography. The Precisionist painters included, perhaps preeminently, Georgia O'Keeffe. Stieglitz not only married O'Keeffe, he made some of the most impressive and moving photographs of her face, which is now an American icon, of her hands, and of her body.

Also important in the group, Charles Sheeler was at once a leading Precisionist painter and an extraordinary photographer. He practiced both arts throughout his career and did so with the quiet brilliance that characterizes the whole movement. And at least two other Precisionists did notable camera work—Morton Schamberg and, a generation younger, Ralston Crawford, whose painting of the Key West Highway is not only one of the great American images, but also reminds you of the straightforward beauty of that structure, nowadays not so easily perceived in driving across it, since it is part of a busy tourist route.

(Depending on where you came in and left in the ongoing story of American modern art, a nomenclatural note may be in order. The Precisionists are the same painters you may at one time have heard called the Immaculates. The choice in San Francisco to use the former term will probably make that the historical word, and a good thing, too. It not only brings process and focus into the name of the style, it also eliminates forever the possibility of members of an important art movement being mistaken for the field-hockey team of a convent school.)

Did the photography influence the painting? Yes, indeed. Was the painting more than just handmade and colored photographs? Very much more. Just by the way, the Precisionist painters were among the first "hard-edge" artists here or anywhere else, although

that term was not used until it became the title of a school of painting beginning in the late 1950s. Edges sometimes look as though cut through the thinnest of paint surfaces with a knife. Those paint surfaces were thin indeed, but they were paint surfaces, stretched taut and giving effects impossible in photography. Many of the photographers composed their pictures "on the ground glass"; but the composition on the easel was always at once more free and more controlled. Whatever the origins in nature, the Precisionist painter was much freer to arrange it all closer to the heart's desire—and the mind's demand—and such rearrangement, devised according to each artist's sensibility, finally, was the essence of Precisionism.

Why wasn't it done before?

If this combination of these painters and these photographers is such a natural one, why has an exhibition of them together never been done on anything like the scale of the San Francisco show? The most notable previous double exhibition was the nonmuseum one of the works of O'Keeffe and Stieglitz in the year they were married, 1924. Barring such extraordinary circumstances, there were and are reasons for its not having been brought off before. Obviously they have been overcome in San Francisco, but they may still cast a shadow on the show for some visitors.

Foremost among them is the very class system in art that Stieglitz formally dedicated his career to ending. As an American student in Germany, he wrote home that he was abandoning the mechanical engineering he had gone to Berlin to study, making photography and optics his lifework and struggling to get photography accepted as an art the same as painting. His struggle has gone a long way, but it has not yet been unequivocally won.

Delaying that victory are some immediately apparent characteristics of photography as against painting, and both are evident in the exhibition. Photographs were—until much later than the prime period here under consideration—strictly black-and-white and there are plenty of people in the field who still believe that black-and-white pictures have a special "photo-ness" that gets lost in color. And, although this can be transcended, photographs are, in the normal run of things, much smaller than paintings. Worst of all, perhaps, photography is clearly produced by a mechanical process. In photography of the kind in the exhibition there is a great deal of handwork added. And the medium has taken over the cachet long present in prints that places a higher monetary value on images actually printed by the artist than on those printed by someone else. A lower value still is assigned those printed posthumously.

Art Museum, University of New Mexico, Albuquerque

In 1930 photo, Walker Evans concentrated on design. He later became famous for Depression-era pictures.

Columbus Museum of Art, Ohio

Charles Demuth took details of construction and made a meticulous canvas, *Modern Conveniences*, 1921.

With all these things working against the idea—and others, as we shall see—it is remarkable that the San Francisco Museum of Modern Art has produced the show with stunning success. The person most responsible for the exhibition, curator Karen Tsujimoto, has also produced a catalog that is the definitive book so far on a long-lasting, widely varied, artistically rewarding and historically important development in American, and world, art.

In photography alone, the work here presented brought to complete fruition—really for the first time—the ambition to be art that hovered around the new medium at least since the 1840s, at its very beginnings. (You can say "at least" since those beginnings, because that ambition goes much further back to the 16th-century dreams and schemes of some sort of mechanical picture-making apparatus called the camera obscura.) For the youthful Stieglitz in Germany, as we have seen, it was a double ambition: to make photography art and to attain for it the recognition it deserves as art.

Dallas Museum of Fine Arts

Only six paintings survive of 12 to 14 Gerald Murphy made between 1923 and 1929. This is *Razor*, 1924.

Five Victorian Foolish Virgins

These artistic yearnings for photography had taken some odd turns in the 19th century. Even as sensitive a portrait photographer as Julia Margaret Cameron was capable of dressing up five Victorian young ladies in vaguely Middle Eastern robes and scarves and calling the picture *The Foolish Virgins*. After all, this was what painters at the time, 1865, were doing in England and elsewhere. Models were hired and posed to act out Biblical and moralizing scenes. As late as the early years of Edward Steichen, that photographer recalled, photographic art was made by imitating Impressionism: "You either spit on the lens or gave the tripod a little kick just as you clicked the shutter."

Elsewhere, earlier in our own century, art in photography was pursued in highly individual ways by Moholy-Nagy, the Hungarian at the Bauhaus in Germany, and Man Ray, the American in Paris; both produced extremely interesting work but both were also extremely interested in other things.

It was the photographers in the San Francisco exhibition who finally created a photography that was indubitably both art and modern. This was achieved by allowing the camera to do what it obviously does best, recording the scene in front of it, helped along, to be sure, by the selection of the scenes and the authoritative control of the glasses, papers, chemicals and lights that are the artist-photographer's materials and tools. The selections were what might have been called the "American scene," for that is what the building arts of the period really constituted.

You can see it clearly in the photographs of Sheeler: New York with buildings pressed together, as it were, in a way a painter would not do because he would not see; a 1927 shot of crisscross conveyors at the Ford plant in River Rouge, Michigan; the smokestacks at River Rouge (p.131), glistening on their left sides, laddered, shadowed, set above the plain, simple architecture of industry, against the sky and the rising steam; and *Drive Wheels*, 1939, a close shot of a locomotive where the wheel meets the steel, with the oil present but wiped clean. It is a vision of driving force, as the title says, and it is no wonder that Henry Luce chose Sheeler early on to work on a commission for six paintings for *Fortune*. Perhaps alone in the country, Luce, that percipient, strong-minded publisher, recognized on sight the community of interest shared by the

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86 Proof Blended Scotch Whisky, © 1982 The Paddington Corp., NY

John C. Waddell, New York

Margaret Bourke-White's sweeping camera portrait of George Washington Bridge was made in 1933.

San Francisco Museum of Modern Art

Dynamism and drama of Joseph Stella's art is clear in *Bridge*, 1934-36. Model was Brooklyn Bridge.

Precisionists and the American corporate enterprise.

Almost all of the great names in American photography during, roughly, the first half of this century are present in the exhibition and often very generously so. Berenice Abbott's New York is highly dramatic, Stieglitz's understated, deadpan. It is a special pleasure to compare his photos and O'Keeffe's paintings of New York vistas of, around or from the Shelton Hotel, where they lived and had their studios. Ansel Adams, now known best for his spectacular Western views, was just as spectacular in his perceptions of the cityscape. And, of course, it is a joy to see a full presentation of the Cleveland pictures of Margaret Bourke-White. She began in Cleveland, becoming one of the first industrial photographers and realizing early the stark power and pictorial, compositional values of the new industrial world. Not only Cleveland, but many other non-New York parts of the country revealed the vision of the Precisionists and the camera workers. Grain elevators are quintessentially Precisionist in form and self-possession, and a number of the artists saw that and show it up to us, most notably Charles Demuth and Ralston Crawford.

It is tempting, if somewhat misleading, to quote Demuth's famous remark (although some look upon it as being apocryphal) about his and John Marin's source of inspiration, which both agreed was French modernism. Marin, said Demuth, "pulled his up in bucketfuls but he spilled much along the way. I had only a teaspoon in which to carry mine; but I never

Author, critic, radio and TV commentator on art, drama and cuisine, Frank Getlein wrote about 17th-century New England in June 1982 issue.

QUICK. WHICH MAJOR CAR MAKER BUILDS EUROPE'S MOST FUEL-EFFICIENT FLEET OF CARS?

DATSUN?

FORD?

HONDA?

VW?

TOYOTA?

GENERAL MOTORS?

FOR THE ANSWER, TURN THE PAGE.

Cleveland Museum of Art

Alfred Stieglitz's *Water Tower and Radio City, New York* was segment of his great portrait series of the city.

San Francisco Museum of Modern Art

Ralston Crawford captured American scene both on film and with brush, as in *Vertical Building*, 1934.

spilled a drop." Of them all, Crawford and, of course, Sheeler get the best double representation in the show, in both paintings and photographs.

They both did both. For most of his adult life, Sheeler made his living as a photographer, a condition which certainly influenced his painting. The sanded, planed and cleaned surfaces of his paintings, the sparseness of his forms, are explained by his rule: "I favor a picture which arrives at its destination without the evidence of a trying journey. . . . An efficient army buries its dead." He also said, "I like for people to wipe their feet before entering my house."

There are surprises. Gerald Murphy turns out to be a Precisionist, which certainly would have surprised him, yet his single picture in the show (p.134), the famous image—all his images are famous: he made so few—of the safety razor, the fountain pen and the safety matches, is certainly painted with Precisionist clarity and definition. Moreover, it can be argued that those three objects, painted in 1924, represented an equal and opposite manifestation on the level of daily life that bridges and buildings did on public life of the ubiquitous corporate impulse.

Murphy turned out to have a fairly infallible corporate impulse himself. He and his wife Sara were charter members of that group of expatriate American writers and artists who spent a lot of time in Paris and on the Riviera, most notably Scott and Zelda Fitzgerald, and Philip and Ellen Barry. Ellen Barry, Phil's widow of some decades now, divides her time between Venice, East Hampton and Washington; in her Georgetown drawing room, over the bar, hangs the archetypal Gerald Murphy: a martini shaker—yes, martinis were shaken in those days—a corkscrew, a cut lemon, a cocktail glass. Murphy would have been pleased. Probably the main reason his output was so small was that, in midcareer, he was called back to New York to take over the management of the failing family firm, Mark Cross, the luxury leather-goods company. He saved the enterprise, made it prosper as never before—and never painted again. Murphy was the prototype hero of at least one, maybe two, of Philip Barry's plays.

The painters and photographers of the exhibition, pursuing only the images they sought and found in the new world growing up around them, nevertheless also performed the essential social function of showing Americans what America, at a certain moment, was becoming. By and large we still live in that moment.

But the whole phenomenon was a moment, both in

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the history of 20th-century American art and in the personal histories of a great many of the artists, more strikingly the photographers than the painters.

Stieglitz himself, to begin at the beginning, exists in our mind's-eye history of photography not for those views of New York rooftops seen from the Shelton, but for earlier pictures; the most vividly remembered of these are probably the steerage pictures and that great image of the horsecar terminal with the steam coming up from the horses on a wintry day. And those hauntingly beautiful images of O'Keeffe are not really Precisionist photography, they are extraordinary portraits.

Berenice Abbott had one whole career prior to her New York pictures, working in Paris and photographing the friends of her employer, the photographer and artist Man Ray. She has had several since, including the "face of Maine" work. And Maine is a long way from New York.

Bourke-White, hired by Luce for *Fortune*, became one of the founding photographers of *Life*. That magazine was the most important single development in the furtherance of the recognition of photography, but despite her stunning first-issue cover photo of a very Precisionist dam, Bourke-White rapidly moved into post-Precisionism with the Depression and World War II and never really returned.

The same change took place with Walker Evans, who began his career with Sheeleresque photos of New York, but made his lasting name with those tenant farmers of James Agee's *Let Us Now Praise Famous Men* and his work for Roy Stryker at the Farm Security Administration.

It is excellent to see the photographs of Ralph Steiner and Willard Van Dyck, but both went on to become much better known for their work in documentary movies.

O'Keeffe, of course, has always had rustic and botanical asides from the city, and after Stieglitz's death in 1946 located permanently at Abiquiu, New Mexico. The New York pictures (p.132) are memorable but the O'Keeffe images in our minds remain the flowers and the desert, both Precisionist in a way, but only in a way.

Precisionism may have been only a moment, but what a moment. It was, perhaps, too austere, chaste, impersonal for the wide public acceptance attained earlier by the Ash Can School, later by the Abstract Expressionists and Pop artists. But it came to grips with a new American landscape of the cities and revealed, in paintings and photographs, a new beauty unlike any we had been taught to appreciate. If you could take the artists out of Precisionism, as was done by Depression, war and Henry Luce, you could not take the Precisionism out of those artists. The clarity, restraint and, yes, precision of the city pictures live on in Evans' so potentially maudlin pictures of the rural poor, in O'Keeffe's by now universally acclaimed florals and adobe houses.

San Francisco and Karen Tsujimoto have made order and sense out of an abundant yet modestly quiet development in American art; this is justice because those painters and photographers did the same for that new America then swarming into upward life in the skyscrapers that are now the familiar environment of every day.

Lent by the artist

Ralston Crawford's painting (opposite) echoes Alma Lavenson's photograph of tanks, 1931.

Joseph Helman, New York

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Save the Sperm Whale.

MILAN MIRKOVIC

Milan Mirkovic from Australia has created a unique method for growing the Jojoba plant. The Jojoba nut contains an oil almost identical in properties to that obtained from Sperm Whales.

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Recording European cave painting.

LUC DEBECKER

Luc Debecker is a Belgian living in Switzerland.

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PROFESSOR MOHAMED KASSAS
President of the IUCN and desert ecologist from Egypt.

MRS. PATRICIA KOECHLIN-SMYTHE
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JOSÉ M. MAYORGA
A Spanish member of the Board of Trustees of World Wildlife Fund International.

PROFESSOR MICHIO NAGAI
Former Minister of Education, Culture and Science for Japan.

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Head of Pathology at the Instituto Nacional de la Nutricion 'Salvador Zubiran', Mexico.

PAUL-EMILE VICTOR
French explorer and writer.

The entries will be judged on the basis of their general demonstration of the 'spirit of enterprise' plus their qualities of newness, originality, inventiveness, interest, feasibility, significance and the likelihood of completion.

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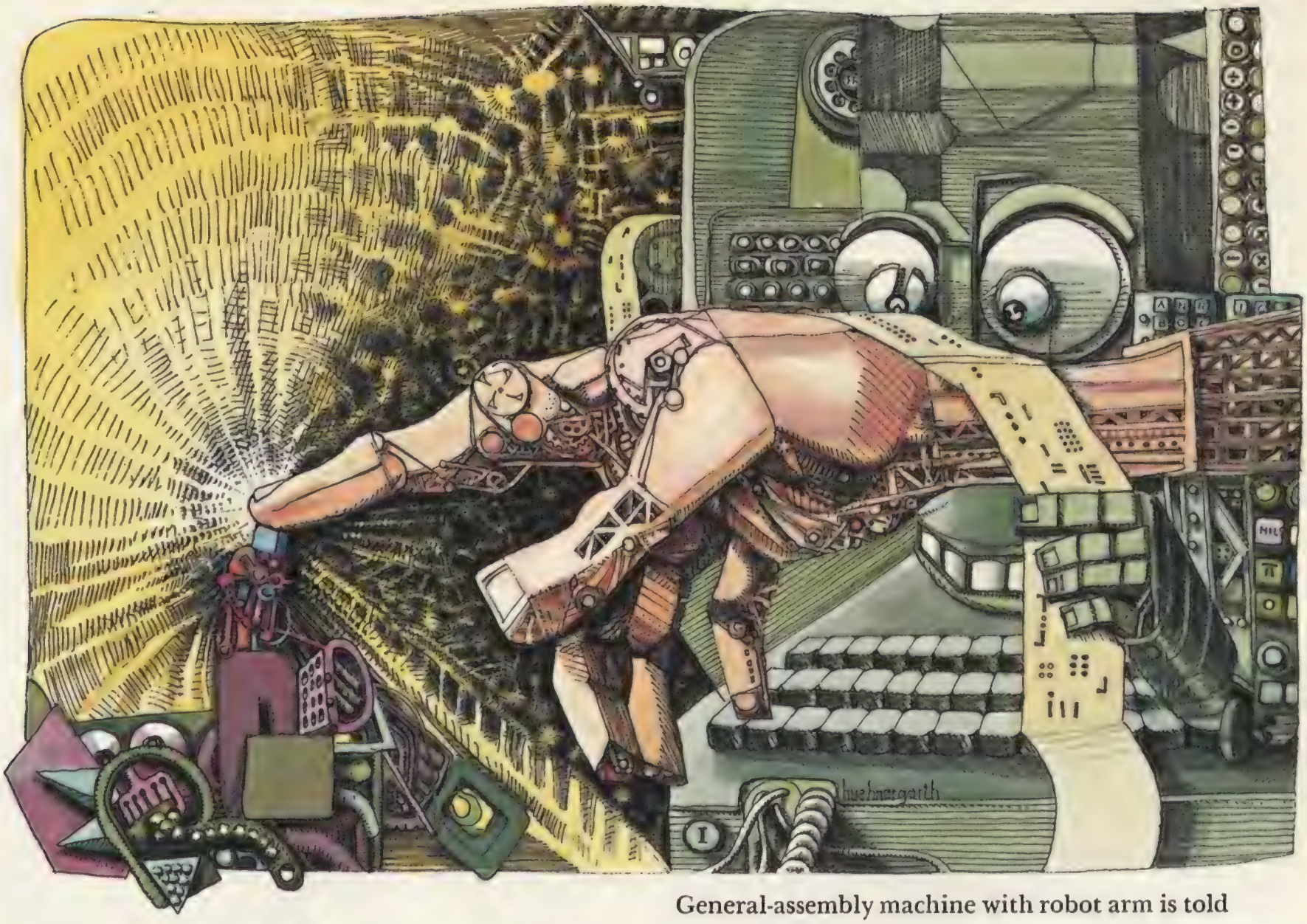


General-assembly machine with robot arm is told what to make by miniature computer "reading" tapes.

By Eric Drexler

Mightier machines from tiny atoms may someday grow

Molecular engineering, using mechanisms like those of viruses and cells, will replace the 'primitive' tools of our industrial epoch

Coal and diamond, cancer and healthy tissue: throughout history, the arrangement of atoms has distinguished the cheap from the cherished, disease from health. Arranged one way, atoms make soil, air and water; arranged another, they make ripe strawberries. Arranged one way, atoms make air and steel fenders; arranged another, they make rusty scrap.

We have come far in our atom arranging, from chipping flint for arrows to machining aluminum for spaceships. We take pride in our technology, with its gleaming metal and desk-top computers. Yet for all our progress in arranging atoms, we still use primitive methods: we handle them not as individuals, but as unruly herds. Like it or not, the greatest technological revolution in history still lurks in the future.

Today's technology builds on an ancient tradition. Chipped flint was the high technology of 20,000 B.C. Our ancestors grasped chunks of flint containing trillions of trillions of atoms and removed chips containing billions of trillions of atoms; they had skills difficult to imitate today, and they did fine work. They had other skills as well: they made patterns on cave

Illustrations by John Huehnergarth

Atoms assemble themselves into part of a machine, forming chemical chain.

walls in France with sprayed paint, using their hands as stencils. In time, they made pots by heating clay, then bronze by cooking rocks. They shaped bronze by pounding on it. They made iron, then steel, and shaped it by heating, pounding and removing chips.

Nowadays we cook up pure ceramics and strong steel, and shape them by pounding, chipping and so forth. We cook up silicon (using pure ingredients in a clean pot), saw it into slices and make patterns on its surface using special sprays and tiny stencils. We call the products "chips," and think that they are small.

Microelectronics has stuffed the monster computers of the 1950s onto a few silicon chips, and sent them speeding away in Japanese motorcycles. Engineers use big machines such as vacuum vapor-deposition chambers to make ever-smaller devices, slinging hordes of atoms at a surface to build up wires and components one-tenth the width of a fine hair. Although small by the standards of flint chippers, these microcircuits remain gargantuan: a single circuit element holds trillions of atoms, and a simple computer chip remains visible to the naked eye.

Yet today a technology is rising on a new foundation. Like microelectronics, it is a technology of the tiny and it also fills the press with news. Unlike microelectronics, it builds devices from the bottom up, putting every atom in its place.

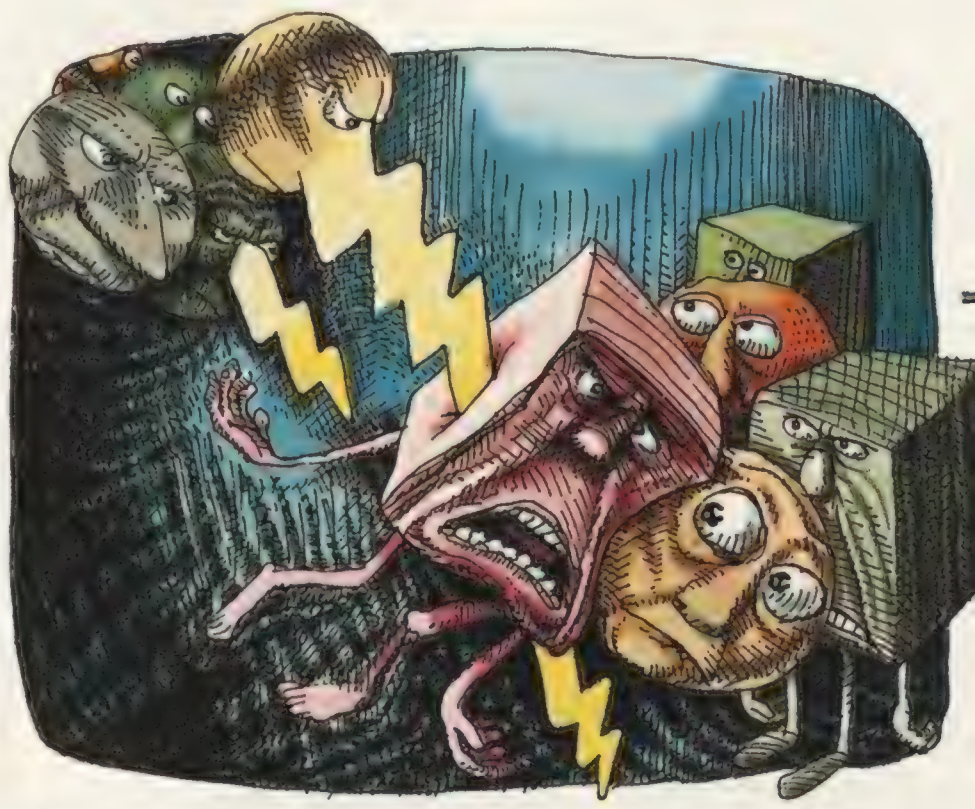
Biochemists use machines made of protein molecules. These machines differ from ordinary machines in many ways, yet like them they have parts of various shapes and sizes that can move with respect to one another. All machines have parts made from clumps of atoms; protein machines simply use small clumps. A chance to build with such tiny devices would drive microcircuit designers mad with joy, yet difficulties remain; while engineers can use photographic reduction to turn drawings into circuit patterns, biochemists must build more indirectly, mixing chemicals in various sequences with uncertain results.

In time, however, advanced molecular machines will let engineers build molecular structures as easily and directly as a microcircuit, or a car. This will change the nature of technology. As the metal machines of the Industrial Revolution spread wealth in a world of poverty, artificial molecular machines will reshape the world as we know it.

Many years will pass before engineers build such molecular machines, yet genetic engineering is already opening a path toward them. The new gene machines lie on this path, and illustrate what chemists can do even today.

Picture clumps of atoms linked by bonds as lumpy beads linked by snaps. To form ordinary polymers, chemists mix the right beads—molecules—in a vessel. These bounce and tumble in the molecular chaos of the liquid, bumping and snapping together. Ordinarily, one snaps onto another until all have joined chains.

In a gene machine, the beads are the letters of the genetic alphabet, the nucleotides—or segments—of DNA, and they are not all thrown in together. To extend a chain, the machine first puts one kind of nucleotide in the vessel to snap onto the chain's end. Then, the machine washes excess nucleotides of the first kind from the vessel and adds other chemicals to prepare the chain ends for the next nucleotide in the chosen sequence. Plastic beads anchor the very first nucleotide



Molecules designed by chemists can be made to "jam" working parts of a parasite, as many drugs now do.

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to keep the chains from washing away with the chemical baths.

Unfortunately, blindly stirring chemicals in a pot leads to addition and deletion errors which become unacceptably frequent in chains more than about two dozen nucleotides long. Genetic engineers first sort good chains from bad, like quality inspectors discarding bad parts before assembling a car. Then, to splice these short chains into working genes (typically thousands of nucleotides long), they turn to molecular machines found in bacteria. Some protein machines, called restriction enzymes, "read" certain DNA words as "cut here." Other enzymes splice pieces together, reading matching parts as "glue here." Together with gene machines to type the "words," these cutting and pasting enzymes let genetic engineers write any DNA message they choose.

If it were not for molecular machines, genetic engineers would never bother to make DNA. In itself, DNA is (heresy!) a worthless molecule. It is neither strong like Kevlar (a plastic fiber stronger and lighter than steel), nor colorful like a dye, nor active like an enzyme. Industry spends millions of dollars making DNA because DNA can provide instructions to molecular machines called ribosomes. First, a machine transcribes genetic information in the nucleus to make RNA "tapes." Then, much as automated machines read tapes and shape metal, the ribosomes in the cytoplasm "read" the RNA tapes and build proteins. This gives genetic engineering its purpose because proteins are useful.

Like DNA, proteins are strings of lumpy beads. Unlike DNA, protein molecules coil up to form small objects able to do things. Some are enzymes, machines that build and tear down molecules (and copy DNA, transcribe it and build other proteins in the cycle of life). Others are hormones, proteins that bind to other proteins in cells and signal them to change behavior.

Absorbing and rearranging with quiet care

Genetic engineering will be able to produce these products cheaply because it can direct the inexpensive and efficient molecular machinery inside living organisms to do the work. Where modern chemical engineering must work with vats of reacting chemicals producing noxious by-products, engineered bacteria can quietly, carefully, absorb chemicals, rearrange their atoms and store the product or release it into the fluid around them.

Scientists are now trying to program bacteria to make human insulin, growth hormone and interferon (an antiviral agent) on an industrial scale. Researchers are tackling the problem of engineering plants that are able to fix nitrogen from the air, thereby making their own fertilizer. Since human DNA is responsible for genetic defects, there is even interest in patching up mutations in human cells, such as those that produce defective hemoglobin in the blood.

Blindly stirring nucleotides in a pot, to make genetic chain, leads to many errors of addition or deletion.

Biochemists have reason to study the workings of molecular machines, both to learn to build them and to learn to wreck them. Around the world (and especially the Third World) a great variety of viruses, bacteria, protozoa, fungi and worms parasitize people. Drugs fight them by jamming their molecular machinery without greatly affecting the molecular machinery of humans. Penicillin, for example, jams machines that build bacterial cell walls, thus killing bacteria while leaving people unharmed. Dr. Seymour S. Cohen, Distinguished Professor of Pharmacological Sciences at the State University of New York at Stony Brook, argues that biochemists should systematically study the molecular machinery of parasites. Once the shape and function of a protein machine vital to a parasite is determined, chemists could design a molecule shaped to jam it and ruin it. Such drugs could free humanity from such horrors as leprosy and herpes.

Eric Drexler is with the Space Systems Laboratory at the Massachusetts Institute of Technology. He is writing a book on the future, and how to make it work.

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In the long run, however, progress will rest not on jamming existing machines with drugs, nor on moving them from cell to cell with genetic engineering, but rather on building new machines to do our bidding. Existing molecular machinery points the way.

In the cell, proteins serve basic mechanical functions. Some push and pull; some act as cords or struts. Parts of some molecules make excellent bearings. A reversible, variable-speed motor drives bacteria through the water by turning a corkscrew-shaped propeller. If someone were foolish enough to build tiny cars around such motors, several billions of billions would fit in a pocket, and 150-lane freeways could be built through our finest capillaries.

Simple protein machines combine to form complex systems. The tape-programmed ribosome is one example; viruses provide others. One virus acts as a spring-loaded syringe, first attaching itself to a bacterium, then punching a hole in its wall and injecting viral DNA. Like a conqueror seizing factories to build more tanks, this DNA directs the cell's machines to build more viral DNA and syringes.

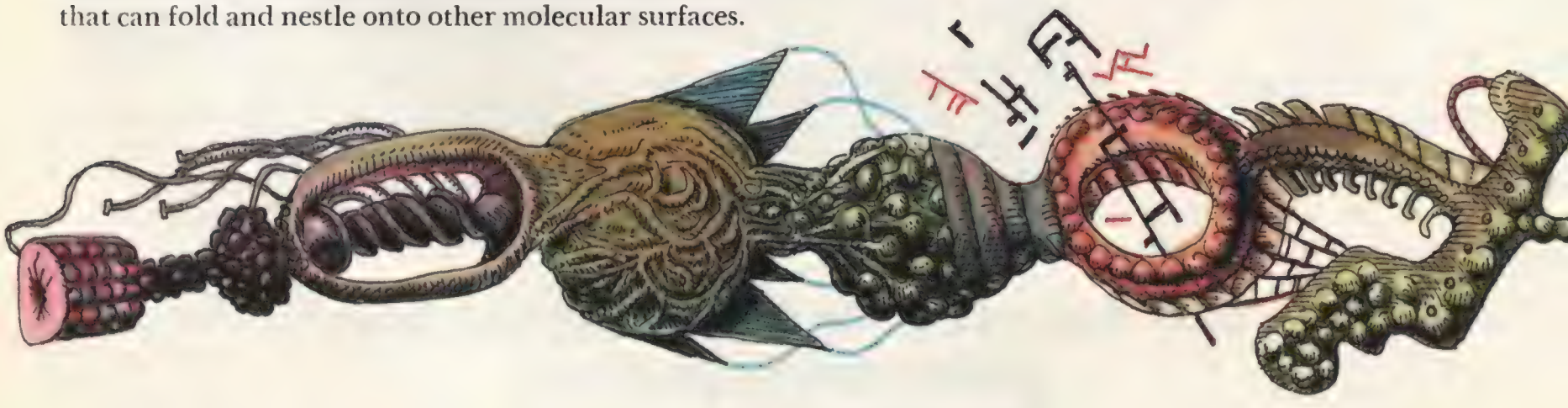
What is more, protein machines assemble themselves, even in the test tube, driven by thermal agitation and thermodynamics. Imagine protein molecules dissolved in water. Each is a lump covered with bumps, hollows and patterns of oiliness, wetness and electric charge. Picture them wandering and tumbling, jostled by the thermal vibrations of the surrounding water molecules. From time to time they bounce together, then bounce apart. Sometimes, though, two bounce together that fit, bumps in hollows, with sticky patches matching—then they pull together and stick. Proteins fit like pieces in a jigsaw puzzle, but form machines. This ability is surprising: imagine putting the parts for a car in a large box, shaking it up, and then finding an assembled automobile inside!

With motors, devices that push and pull, and parts that move on bearings, engineers build complex machinery. Today they use plastic and steel, and build robot arms to handle car parts. Tomorrow, when biochemists master the art of protein design, engineers will build robot arms to handle individual molecules.

How far off is such an ability? In 1959, many geneticists called engineering impossible; today, it is an industry. With biochemistry and computer-aided design exploding fields, protein design may come sooner than one might think. Already, biochemists have mapped the structures of many proteins. With gene machines to help write DNA tapes, they can direct cells to build any protein they can design. The real difficulty lies in knowing how to design chains that will fold to make proteins of the right shape and function. Because the forces that fold proteins are weak and the number of plausible ways a protein might fold is astronomical, designing a large protein from scratch remains beyond reach.

Nevertheless, biochemists have already designed short chains of a dozen or so pieces that fold and nestle onto the surfaces of other molecules as planned, and have rebuilt existing enzymes, slightly. James H. McAlear of EMV Associates Inc., Forrest L. Carter at the U.S. Naval Research Laboratory, Kevin M. Ulmer of

Biochemists have designed short molecular chains that can fold and nestle onto other molecular surfaces.



Doctors will be able to design "cell-repair machines" that can search out and destroy agents of disease.

Genex Corporation, and researchers in university laboratories around the world are already beginning theoretical work on molecular switches and memory devices that might be incorporated into a protein-based computer.

Whether used to make gears or computers, however, protein machines have shortcomings. They quit when dried, freeze when chilled, and go to pieces when heated. Engineers do not build from flesh, hair and gelatin; long ago, people learned to use their hands of flesh and bone to build machines of wood, ceramic and steel. Similarly, we will use protein machines to build machines of tougher stuff.

Using tapes to direct them, like ribosomes or automated machine tools, protein machines could build nonprotein machines of more solid structures like metals, glass and diamond.

Machines of such stuff, the machines of the second generation, could be rugged. Able to tolerate acid or vacuum, freezing or baking, machines with such parts could use as "tools" almost any of the reactive groups used by chemists, and they could use them with the precision of programmed machines. With such machines, we will gain a basic ability lacked by all past history: the ability to place atoms in any reasonable arrangement, the ability to build all that the laws of nature permit.

And why not? Artificial machines already improve on evolved machines. Cars outspeed cheetahs, jets outfly falcons and computers already outcalculate head-scratching humans, though they are still made by the chipping, cooking and stencils of bulk technology.

Today, engineers make irregular patterns on the surface of silicon chips by throwing atoms and photons at them, yet the direction of progress clearly shows the value of miniaturization. Tomorrow, engineers will build circuits to atomic precision, and they will build in three dimensions. The limits of electronic technology remain uncertain (the quantum mechanics of electrons in networks of tiny structures present complex problems) but, whatever they are, they will be reached.

Though some computers of the future will still use electronic effects, the smallest computers may not. This may seem odd, but the essence of computation has nothing to do with electronics. A digital computer is a collection of switches able to turn each other on and off. Its switches start out in some pattern (perhaps representing 2 + 2), and then switch each other into a new pattern (representing 4), and so on—such patterns can represent almost anything. We use tiny electrical switches connected by wires simply because mechanical switches connected by rods or strings would be big, slow and expensive, using bulk technology.

The idea of a purely mechanical computer is hardly

new. In England in 1834, Charles Babbage invented a mechanical computer built of brass gears. With components a few atoms wide, however, a simple mechanical computer would fit within 1/100th of a cubic micron, many billions of times smaller than today's so-called microelectronics. Even with a billion bytes of added memory, such computers could fit into a box a micron wide. Small size would make them fast. Although mechanical signals move about 100,000 times slower than the electrical signals in today's machines, because they need travel only 1/1,000,000th as far they face less delay. Thus, a mere mechanical computer could work faster than the electronic whirlwinds of today.

Will such intricately-patterned matter cost a great deal? If each atom cost even 1/100th of a cent to position, then a block the size of a sugar cube would cost more than $10 billion billion to build; if this calculation were to make any sense at all, the whole idea might safely be ignored.

Once again living systems point the way. Growing bacteria show that molecular systems can build copies of themselves if given room and common materials (garbage, for example). Similarly, a device able to pick up atoms and assemble them according to instructions would be able to build a copy of itself. It would need a computer to direct it and a tape to store the instructions, but it could build a duplicate computer and copy the tape, thus replicating the entire system.

Replicators double with each replication, multiplying exponentially. In mere hours or days one microscopic replicator could turn a ton of raw materials and some fuel into a ton of general-assembly machines, able to make almost anything.

Picture a general-assembly machine as a stubby robot arm a few hundred atoms long and a hundred atoms wide. Behind it sits a computer reading a tape, and in front sits an unfinished structure. Tubes or conveyor belts bring molecules to the machine. Some molecules supply energy to motors driving the computer and arm; others supply groups of atoms for the arm to pick up and place where the computer directs. Atom by atom (or group by group) the arm moves pieces into place. Chemical reactions bond them to the structure on contact.

This may seem a tedious process, but tiny arms could move quickly. We are used to thinking of the way human arms wave or human fingers flutter; of the way hummingbird wings hum and mosquito wings whine. But for arms so small, to handle a million molecules per second would be to move in slow motion. Ordinary enzymes do as well using motions driven by thermal jostling. An assembly-machine system might contain billions of atoms, yet it could copy itself in a matter of minutes, like a bacterium.

These machines could then be turned to making other products, such as small computers, strong diamond fiber, industrial-grade synthetic muscle, molecular machines able to break down rock and separate pure metals, and more. Though tiny, molecular machines can build big. Molecular machines working together build whales; seeds replicate their machinery and organize atoms into vast structures of cellulose, building redwoods. In time, we could build "seeds" able to soak up air, water, soil and sunlight to build simpler things—houses or spaceships. Yet building, even without labor or pollution, may seem trivial once medicine makes use of molecular machines.

Moving beyond handling atoms in bulk

Today, medicine works by cutting, irradiating and mixing chemicals. Surgeons wield knives, slicing the delicate machinery of a million cells at a stroke. Doctors bombard tissue with radiation, hoping to harm tumors more than the tissue around them (SMITHSONIAN, October 1981). They prescribe chemicals, releasing molecules to wander and tumble through the body liquids. Saws cut bone. Like the rest of today's technology medicine handles atoms in bulk.

With continuing advances in drug design, however, medicine is moving toward sophisticated molecular technologies. Biologists already use molecular devices to study cells; enzymes help identify chemicals, antibodies tag proteins, and viral syringes inject DNA into bacteria.

As molecular machines and computers grow more advanced, biologists will move beyond simply smashing cells, peering at them through microscopes, and probing them; they will instead use advanced machines to probe and repair cells swiftly and directly, learning both structure and function. In time, biolo-

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gists will catalog the tens of thousands of kinds of molecules in the body, and will map the structure of the hundreds of kinds of cells.

Cell-repair machines will take decades to develop, but they lie straight ahead. The medical need for new drugs and proteins already leads researchers, step by step, along a path to advanced molecular technology.

At this point, the idea of a technology that promises both a cornucopia and a panacea may well seem too good to be true. But should this news be surprising? These possibilities are part of nature, built into the structure of natural law. Biochemical systems already build with atoms; designing new machines will demand much engineering and detailed research, but no novel laws of nature. In a world made of atoms, the ability to handle atoms is basic; important, new and therefore startling consequences follow as summer follows spring.

Nevertheless, the picture painted above should seem suspicious because it is incomplete. Long ages ago, perhaps to guard against buying magic charms from shifty-eyed strangers, people learned to disbelieve tales of easy riches. They have since learned a similar lesson about technology. Chipped flint killed both game and people. Rockets both opened space to development and London to bombardment. Molecular technology, too, brings dangers on the scale of its benefits.

Consider one example: the danger of uncontrolled replicators. Recombinant DNA technology brought fears of the creation of a monster bacterium able to infect people or upset the ecology of Earth. These fears lessened as people realized that genes have been recombining for ages in nature, and that laboratory bacteria are pampered creatures unable to compete with bacteria adapted to the outside world. Artificial self-replicating molecular machines, however, might have no effective predators or competitors to keep them in check. Solar-powered replicators could operate like plants or bacteria, but with greater energy efficiency, no vulnerability to disease, and little sensitivity to moisture, temperature, or soil composition. Replicators could act like bacteria, but with omnivorous tastes and few weaknesses. Any ecologist should see the danger: uncontrolled replicators could destroy the biosphere, and all we value. The danger is distant, but real.

We can avoid such dangers, for a time, through simple safeguards. It will be easy enough to build all replicators with a need for artificial "vitamins" made only in the laboratory, thus tying them to human control. We must, however, use the time gained to develop means of preventing the deliberate redesign and misuse of replicators. Although possible, this poses a challenge of a different order; meeting it while preserving our liberty may one day be our greatest task.

Our world holds more than a hundred competing countries, and industrial companies beyond count. Most work today aims at such short-term goals as better drugs and better understanding of the processes of life. Nevertheless, governments, universities and chemical, electronic and pharmaceutical companies from Europe to Asia have set out on a path that leads ultimately to molecular machinery.

The incentive to continue will only increase. In a competitive world, if something is possible, shows long-range promise and offers short-term payoff, it will be developed. We must count on a future with molecular technology, like it or not.

Fortunately, molecular technology can bring more than an era of health, wealth and tiny computers: it can help resolve the conflicts that divide humanity. Today, industrialists and environmentalists are at odds not because the former like pollution or the latter scarcity, but because industry cannot avoid polluting while producing. Molecular technology can reduce this conflict by making manufacturing as clean as an apple orchard, and transportation far cleaner than horse-drawn carriages.

Expectations shape actions, and expectations rest on a view of the future. The idea of molecular technology brings a new view of the future, and with it a new view of the world and a new framework for action. If we stumble forward blindly, as if molecular technology were a mere idea about some stuff in a test tube, we will reap the benefits late, while risking destruction. We have little choice but to open our eyes, to think hard on what we see, and to act as wisely as we are able.

Artist's conception of future technology includes giant machine built, atom by atom, from protein parts.

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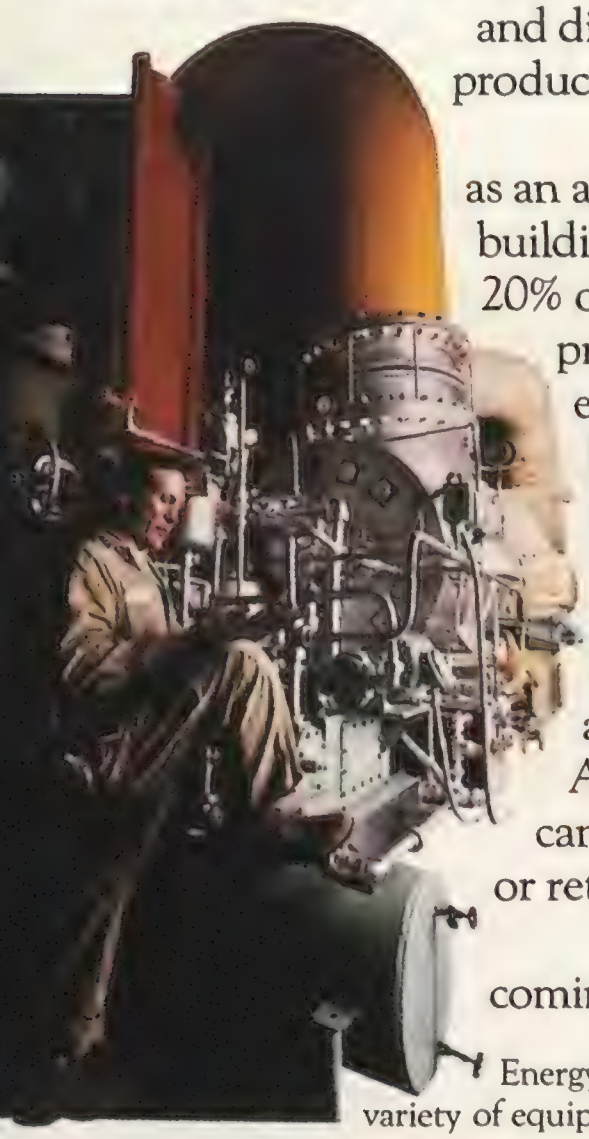

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The knowledge business

By Roger G. Kennedy

Wondrous diversity is lasting glory of American churches

Should a place of worship be simple or full of pomp? Both views have been beautifully expressed in U.S. design from earliest times

In Philip Johnson's open-air Roofless Church in New Harmony, Indiana, canopy shelters Lipchitz sculpture.

At the end of the second century, Clement of Alexandria, an early Christian theologian, warned his readers not to be too interested in architecture: "A temple is not a building but the gathering of the elect," he wrote.

Fifteen hundred years later, Anne of Austria, once a Queen of France, expressed another view of the matter: "The church must be a sumptuous and magnificent sanctuary in order to compensate as much as possible for the extreme vulgarity and poverty of the place where the Eternal Word chose to be born."

In America, both views have been represented. Many worshippers have gathered with such an intensity of relationship among themselves that they have had no more concern with their surroundings than did Clement. But it was not poverty that kept Puritan churches simple; it was a desire to avoid what they felt to be distraction. Religious people came to simplicity in a number of surprisingly similar places from very different directions. I find it remarkable how similar is the feeling one gets among the dark shadows and the white walls of a New England church and the dark shadows and white walls of a desert church in New Mexico. In the latter, of course, there are also likely to be intense concentrations of color and iconography, reminding us of the Roman Catholic tradition of the Franciscans, in the form it reached our Southwest, which included intense symbolism; here one experiences an equally intense provision of space for each worshipper's imagination. Yet in many such places the atmosphere remains as serene and uncluttered as in some meetinghouses in Vermont.

It is easy to patronize the point of view of Anne of Austria; she seems so patronizing herself. But within her understanding, she was genuinely humble. What she intended was the putting in service to God of the best craftsmanship available, and the allocation of financial resources to that service on the part of persons like herself who made no pretense of possessing artistic talent. It is not so bad for a client and architect to serve a common public purpose which extends beyond their own time, place and self-interest.

The wonderful diversity of points of view served by American architecture for worship is our special glory. Other countries manifest one or another of these with equal elegance or skill, and sometimes on a scale we cannot match. But our diversity itself is a theological statement. We are a coming together of many traditions, many temperaments, many experiences.

The places pictured on these pages can give some sense of the economic and ethnic diversity of Americans, our social and religious history, our politics, psychology, economics and artistic genius. They are something more important than any of these; they are places in which people assemble to put their attention

St. Patrick's Cathedral, New York, built 1858-88, was thronged during Pope John Paul II's visit in 1979.

Christ Church in Lancaster County, Virginia, dates from 1732, embodies ideals of Southern landed gentry.

upon the most serious matters of their lives, in consciousness that their souls are affected, always and in all places, by mystery as that is defined in the Oxford English Dictionary: "a religious truth known only from divine revelation; usually a doctrine of the faith involving difficulties which human reason is incapable of solving."

People brought up to distrust iconography, or who are made uncomfortable by too much color in stained glass, may not easily understand those who are stimulated to more intense religious experience by such objects. Maximus the Confessor, in the seventh century, offered us a way to do this, a way he called "symbolic contemplation." If we contemplate such an object with sufficient intensity and fixity, it seems to me, we may be able to approach the invisible reality that lies behind it. The holy object is important, one then discovers, not truly as an object but as an aperture. It is a surface which, under fixed, rapt, devoted and fearful attention, dissolves to provide a glimpse into another world.

Thus a window of stained glass becomes an icon, an

Splendid sanctuary in New York's Temple Emanu-El serves a house of worship that seats 2,500 people.

North Christian Church in Columbus, Indiana, was designed by Eero Saarinen just before his death in 1961.

image which can be seen and then seen through as it becomes insubstantial. The architecture surrounding such a window is a frame around a dissolving image. Then, in turn, the whole wall dissolves, as it does in the great Gothic churches, to become a transcendent vision of heaven.

Medieval architects did not insert stained glass in windows, as we might, to make a wall pretty or to throw colors against the motes of dust in the shafts of sunlight within, but because they expected those who looked out toward the sun through those dissolving, transparent walls to be engaged in symbolic contemplation of an eternal tabernacle. Gothic architects built as much with light as with solid materials, believing that their work was a reflection of the Creation itself.

In our own time, some people are tempted to ask, "Why don't they build something that looks like a church?" "Why aren't all our churches 'churchy'?" Perhaps it is because we are not all agreed, and never have been, upon what does "look like a church."

Take the church tower, or the spire, for example. The early New England meetinghouses often did not have towers (the Puritans rejected such "churchy" things); in Virginia, the earliest parish church built of permanent materials did—to hold bells. This was obviously not just happenstance. It is a sign of differences in points of view—differences giving us an occasion to deal with the cliché that "aspiring" Gothic pinnacles represent some sort of reach toward Heaven. That is not why evangelizing friars of the Southwest built towers atop their missionary outposts, nor why busy trappers and corn growers around the Chesapeake built towers. They did so not to reach toward heaven but to call to each other, and to invite strangers. The Separatists and some of the Puritans of New England were not interested in converting others; they were inward-looking. Their meetinghouses, at the outset, were not invitations nor were they statements of

Roger G. Kennedy, Director of Smithsonian's National Museum of American History, has expanded on this article in his new book, American Churches, *to be published this month by Stewart, Tabori & Chang, Inc.*

Site of the United Methodist Church in Graniteville, Massachusetts, was mill-owner's gift (1869) to workers.

Original wrought-iron hinges embellish Gothic doors of York Street Baptist Church, York, Maine, 1892.

Stannard-Greenboro Bend Methodist Church, 1888, in Stannard, Vermont, is primly New England.

Congregational Church in East Machias, Maine, is exactly the same today as when it was built in 1836.

continuity of religious tradition. These people were protesting those aspects of religion they felt to have become diseased. All this changed in time, but once there was a genuine distinction in religious significance between the towered Gothic and the towerless meetinghouse of very early New England.

While these distinctions later dissolved in the interactions of the colonists and the softening of the Puritan spirit during the 17th century, their appearance in the earliest Colonial architecture presents an opportunity to inquire why people have taken the trouble to build church towers.

Seen from a distance, the spire leads the way to the church, and is intended to be seen. From that tower toll the bells, solemnly sounding the same refrain, on the hour, every day, every year, every decade.

Enduring message of the spire

Inside the Gothic church the message is the same: continuity, reassurance, reaffirmation. The rhythm seems to be from above downward, as much as it is the other way around. From the outside it appears as if the spire were seeking the light; inside, one sees the light coming through the colored glass of the windows to seek out the worshippers. Like all shadowy church interiors, Gothic spaces admit only a few shafts of direct sunlight. Something intervenes almost everywhere, glass or a reflecting surface, so the light comes from unusual angles, many-colored. In the nave of New York's St. Vincent Ferrer, Bertram Goodhue's masterpiece—as in St. John's Abbey church in Minnesota, Marcel Breuer's masterpiece—the light is broken into varicolored shafts emerging from unexpected sources, and gives the worshipper an impression of a density of hovering spirits.

This light, to me, is not the direct statement of the sun, but a light in which humanity has participated. Human craftsmen have intervened to condition the light by their craft. It is as if they were asking, thereby, a reciprocal intervention in their lives by nature's God. Something of this feeling is invoked even in the very simple, originally uncolored but filtered light in spaces like that of the 17th-century St. Luke's at Smithfield, Virginia—which was then upon a very uncertain colonial frontier—and in other "frontier Gothic" churches such as the Tualatin Plains Presbyterian Church at Hillsboro, Oregon.

In the Southwest, the twin towers and massive facades of mission churches, unornamented except about the doors and windows, incorporated a different aspect of light in their architecture. One of the oldest churches of European construction in the United States is at Acoma, New Mexico. It was built as early as 1629. It had been abandoned for a while in the 19th century; in 1927 it was described by Willa Cather in her *Death Comes for the Archbishop*:

> The top of the mesa was about ten acres in extent . . . and there was not a tree or a blade of green upon it; not a handful of soil, except the churchyard, held in by an adobe wall, where the earth for burial had been carried up in baskets from the plain below. The white dwellings . . . huddled together in a close cluster, with no protecting slope of ground or shoulder of rock, lying flat against the flat, bright against the bright—both the rock and the plastered houses threw off the sun glare blindingly.

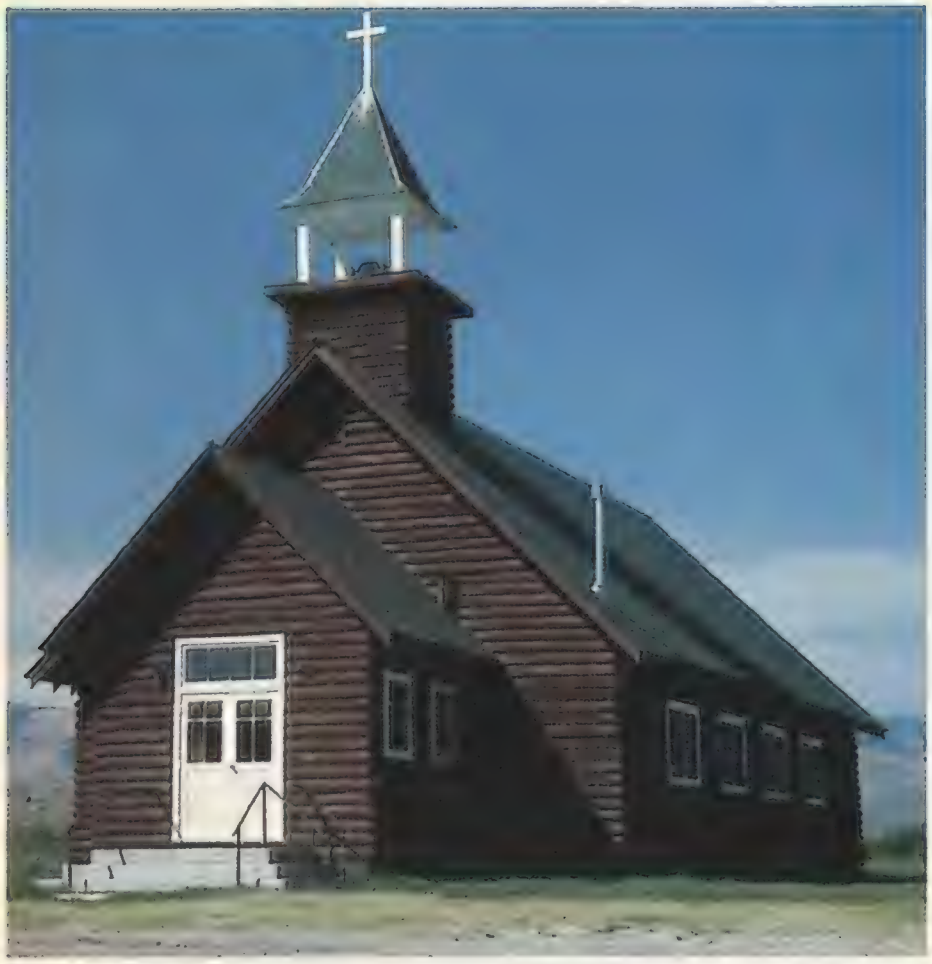
The glare is not just the sun, not just the heat, not just the impenetrable surfaces of the rock and the rock-like sky—the glare is harsh physical reality. Strongholds like this, and like their Baroque predecessors in Europe, provide, in their depths, the grace of shadow. They offer surcease from the battering of the sun and the brutal realities it discloses. The architecture of the mission churches of Texas, New Mexico and California is an architecture of protection from a dangerous world. It is like the architecture of Albi and other fortified cathedrals of France and Spain.

It is also like many Jewish places of worship (p. 161) in their sparing use of light. Among Jews the association of light with the enigmatic qualities of the deity is ancient indeed. Their God, who fixed the sun in the heavens and blinded Moses, who tried to look upon His face, dwelt "in the thick darkness" (*I Kings 8:12*) and "made darkness His secret place" (*Psalms 18:11*).

Different ways of paying attention

Like the varying uses of light, the ways in which congregations are seated, or do not sit, reveal very great differences in the axes of attention in different churches. By this I mean that there are a number of quite distinct ways in which the iron filings of emotional commitment are drawn along the lines of force within a space used for religious purposes. These axes, some suggested by Basil Minchin, might be described as: "Out there," as in a basilican church, facing the altar; "Up there," as in a domed church, particularly those with very powerful iconography directing attention upward, as if to some literal heaven; "With us," as in those concentric spaces (pp. 160-61), seldom exactly circular, in which participants are encouraged to look at, and look to, each other; "Within me," as in monks' cells where there is no distinct focus of attention, no altar or reading desk, no pulpit or font, no icons or symbols, merely a space apart from the world.

Television producers call spaces like this "limbo sets." This term would not mean very much to hermits; but it is not a bad way of expressing the feeling



St. David's Episcopal mission church, Fort Washakie, Wyoming, is on Wind River Indian reservation.

In 1962, St. Louis Priory in St. Louis, Missouri, was designed in contemporary style at Benedictines' behest.

one sometimes has even in the most richly ornamented of spaces. Sometimes a moment comes when the outer eye closes and the inner eye opens. Sometimes this happens precisely because the external symbols have been so powerful as to deprive the ordinary world of its noisy and insistent distractions.

Early American religious architecture in the Northeast and the Southwest was spare, by necessity and by design. There were no very large churches. That meant that they could present no long vistas, and there were no great areas reserved for processions. The church was built to accommodate a congregation, and in the Protestant colonies nearly all such structures had a congregation of only one sort: there was no division of space between laity and clergy. The chancel, therefore, was small until well into the 19th century, when for the first time choirs in some places reenacted the ancient role of the clergy by singing *to* the congregation rather than with the congregation.

Christopher Wren established in Britain the kind of church interior we call "Colonial": a large room, unbroken by screens, essentially uninterrupted by pillars, intended to permit everyone to hear and see the ecclesiastical drama. The important functions of these churches are pressed against the walls. The baptismal font is on one wall, most often at the door, the pulpit and reading pew to the side, and the altar in front. They are designed to permit easy traffic flow by communicants who leave their seats and go to the front to receive communion or, later, by members of the congregation who leave their seats to offer communion to others who remain seated.

This is not, of course, the pattern of the Gothic or Romanesque church, though in Spain there was a group of Gothic churches with extra-wide naves, intended to permit a large congregation to worship together in full view and sound of the same events.

The Puritans sat interminably

In medieval churches the teacher sat. The bishop occupied his seat (the cathedra). Learners stood, except when they were kneeling to pray or to receive the sacraments. The reverse pattern, familiar to us, in which the minister stands while the congregation sits, imparts a different message, implying less deference to the preacher.

It was the Puritans, especially, who stressed the seated congregation, though anyone who has sat for long in the seats they occupied knows that they did not do so out of much regard for comfort. They emphasized a lengthy discourse upon an equally lengthy reading of scripture.

In the 19th century, architecture encouraged congregations to focus attention upon the Word (from the

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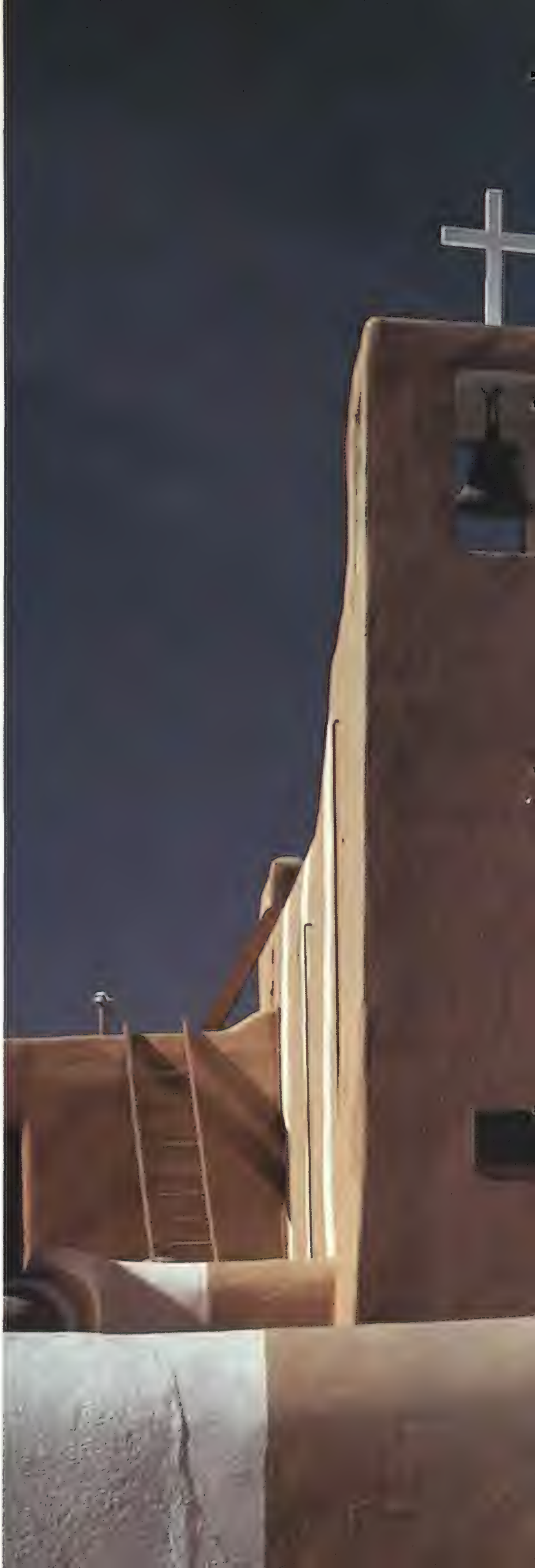
pulpit), the Eucharist (the communion table), the Covenant (expressed in the baptismal font or pool), or even upon the assembled group itself.

The elect did not spend all of their time in the church, nor was all of the liturgy inside the church, then or now. The orderly design of the New England village was liturgical, and so, too, was the choreography of its daily life, its goings and comings about the church/meetinghouse. Such a village has almost the order and choreography of a monastic community. There is a wholeness in such a place. As the New England migration began at the end of the 18th century to spread across the state of New York, across the Great Lakes states and finally to Oregon, that wholeness reappeared constantly. Villages grew around the "green" to be identified by the steeple. Later, when the church moved to the side street, replaced by the bank and the county courthouse, it was clear that what historians have called the Peaceable Kingdom had gone.

We need not express nostalgia for the tight and tidy external life of such communities. We know enough now about their internal life to know that all was far from tranquil, however peaceable it may have seemed. We can, instead, be given some perspective upon our contemporary efforts to come into more kinetic relationships with the mystery, if we recall how many of our fellow beings have been at that effort for so long, in so many ways, in so many places. Perhaps we may be emboldened to consider our own ways more worthy than we might if there were less diversity in the devices of those who came before us. They have left us plenty of room to try.



Church of San Geronimo, Taos Pueblo, New Mexico; still-inhabited pueblo may be seen through its gate.

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By Walter Lord

Miracle at Dunkirk

In May 1940 the cream of the British army faced annihilation in France; incredibly, they were saved by a brave, improbable fleet

Like Waterloo and Gettysburg, the French coastal town of Dunkirk has given its name to history. A year and a half before the United States entered World War II, Dunkirk was the scene of a staggering defeat for the British and the French, an overwhelming victory for Hitler's armies. Yet to the Allies Dunkirk came to signify not defeat, but triumph.

In the spring of 1940, the Germans launched lightning attacks into Holland and Belgium and across northern France toward the English Channel, trapping French and Belgian units and nine divisions of the British Expeditionary Force that had been sent to help in the defense of France. As the Germans tightened their cordon, the British ran a gauntlet of artillery and screaming dive-bombers to the beaches of Dunkirk. There, along with large numbers of French soldiers, they were rescued, against all odds, by the Allied navies and thousands of civilian sailors who came to get them in warships, lighters, scows, yachts—anything that could get across the Channel. The stubborn determination of the troops and the courage of the seamen filled the Allies with pride, and gave them confidence in the final outcome of the war.

Walter Lord, best-selling author of A Night to Remember *and other books, spent four and a half years, much of it in Europe, and was in touch with 500 survivors to recreate the story for his new book,* The Miracle of Dunkirk, *to be published later this month by Viking Press. The following article is an adaptation.*

Every man had a special moment when he first knew that something was wrong. For Winston Churchill it was 7:30 A.M., May 15, 1940. At Admiralty House, the bedside phone rang: French Premier Paul Reynaud. "We have been defeated," Reynaud blurted.

Silence, as Churchill tried to collect himself.

"We are beaten," Reynaud went on. "We have lost the battle."

"Surely it can't have happened so soon?"

"The front is broken near Sedan; they are pouring through with tanks and armored cars."

It seemed incredible. The French army had been regarded as the finest in the world. When Hitler finally struck at Holland, Belgium and Luxembourg, the Allied Commander, Gen. Maurice Gamelin, was convinced that the attack was a replay of 1914. He rushed his northern armies to the rescue.

But it was not 1914. Instead of a sweep through Flanders, the main German thrust was farther south, through the "impenetrable" Ardennes Forest. The

Britain's motley armada braves bombs in scene painted soon after fact by artist Norman Wilkinson.

'With toy whistles attached to planes and bombs . . . they screeched down in an orgy of killing and terror'

German Stuka dive bombs a lone Allied tank during Hitler's onslaught through northern France.

French had not bothered to extend the Maginot Line to cover it. Spearheaded by tanks and supported by Stuka dive bombers, German columns stormed across the Meuse and were knifing through the countryside.

General the Viscount Gort, burly Commander in Chief of the BEF, was no strategist, but he was a great fighter and completely unflappable. On May 16 he began pulling his front-line troops back to establish a new line. But Stukas poured out of a dazzling sun. With toy whistles attached to planes and bombs (the Germans called them "trumpets of Jericho"), they screeched down in an orgy of killing and terror. Pulling out of their dives, they flew along the roads at car-top height, strafing for good measure.

The hot, still air filled with black smoke and the smell of burning rubber. Traffic slowed to a crawl. Weeping refugees swarmed among the dazed troops. Discarded handcarts, bicycles, baby carriages, burnt-out family cars cluttered the roadside.

Rear-guard units were all that stood between the mass of retreating troops and the advancing Germans Some, like the Coldstream and Grenadier Guards, were regiments of legendary discipline. Others were less famous but no less professional. The routine was to dig in behind a canal or river, usually overnight, hold off the German advance during the day, then pull back and repeat. These units were as efficient as machines, but no machines could be so tired. Digging, fighting, falling back, the troops had no time to sleep. The 1st East Surreys invented a way to doze on the march. Linking arms, two outside men could walk a sleeping man between them. From time to time they would switch places.

When Lt. James M. Langley of the 2nd Coldstream was put in charge of the bridge across the Escaut at Pecq, his company commander, Major McCorquodale, ordered a sergeant to stand by and shoot Langley if he tried to sit down. Langley's job was to blow the bridge when the Germans arrived. As McCorquodale explained to him, "The moment you sit down, you will go to sleep, and *that* you are not going to do."

Communications collapsed. The French did not trust the radio, and the telephone system was a shambles. Driving through the countryside, Gen. Bernard Montgomery, jaunty commander of the BEF's 3rd Division, had a unique solution. "Monty" would jam a message on the end of his walking stick and hold it out the car window. It would be plucked off by his guard, Sgt. Arthur Elkin, on a motorcycle. Elkin would then scoot off to deliver it. Once, hoping to get directions, he rode up to three soldiers sitting on a curb. As he approached, one soldier put on his helmet —and Elkin realized that they were Germans.

To General Gort, the communications breakdown

Men of the British Expeditionary Force trudge into shattered Dunkirk with orders to escape by sea.

was one more item in a growing catalog of complaints against the French: Gamelin was a forlorn cipher; the French troops seemed totally demoralized. Their horse-drawn artillery and transport cluttered roads, making for huge traffic jams. More than one confrontation was settled at gunpoint.

It is hard to say when the idea of evacuation dawned on Gort, but the moment may well have come around midnight, May 18, when Gen. Gaston Billotte, commanding the French First Army Group, visited Gort's command post. Normally a bluff, hearty man, Billotte seemed weary and deflated as he unfolded a map. Nine panzer (armored) divisions had been identified sweeping toward Amiens and Abbeville—with no French units blocking their way. It appeared that the only move was northward toward the French port of Dunkirk on the English Channel.

At 11:30 the next morning, Gort's Chief of Staff telephoned the War Office and broke the news. In London it was a serenely beautiful Sunday, and the elegant War Secretary, Anthony Eden, was about to join Foreign Secretary Lord Halifax for a quiet lunch. Then he received an urgent call to see Gen. Sir Edmund Ironside, Chief of the Imperial General Staff. A hulking man inevitably nicknamed "Tiny," Ironside was appalled by Gort's proposed move to Dunkirk. It would be a trap, he declared.

Churchill agreed. The only hope was to drive south and rejoin the French on the Somme. The others fell into line. Ironside should go to Gort this very night and hand him the War Cabinet's instructions.

Shortly after 7 A.M., May 20, the tanks of two panzer divisions of Gen. Heinz Guderian's crack XIX Corps rolled west from Péronne. By 10 they were clanking

'Nearly a million men were now sealed in Flanders, pinned against the sea, ready for the plucking'

Lord Gort, left, commander of the BEF, confers with commanding officer Gen. Maurice Gamelin.

through Albert, where untrained British Territorials tried to stop them with a barricade of cardboard boxes. By noon, the 1st Panzer Division held Amiens, and Guderian took a moment to savor the cathedral. The 2nd Panzer's tanks rolled on. At 9:10 that evening they reached Abbeville and then the sea. They had come 40 miles in 14 hours, cutting the Allied forces in two. The British Expeditionary Force, two French armies and all the Belgians—nearly a million men—were now sealed in Flanders, pinned against the sea, ready for the plucking.

At 6 A.M. on the morning of the same day, Ironside, just off a special train, barged into Gort's command post, south of Lille. Turn the army around, he said, and head for Amiens.

Gort explained that the BEF was locked in combat. It simply could not turn around and go the other way. Then, asked Ironside, would Gort spare his two reserve divisions for a push south which might link up with a French force pushing north? Gort thought that was worth trying.

Ironside rushed down to French headquarters. He found Billotte with General Blanchard of the French First Army, the two trembling and shouting at each other. Neither had any plans at all. It was too much for the volcanic Ironside. Seizing Billotte by his tunic, he literally tried to shake some spirit into the man. Little was accomplished. The British drive south petered out. The French attack north never materialized. The trap held.

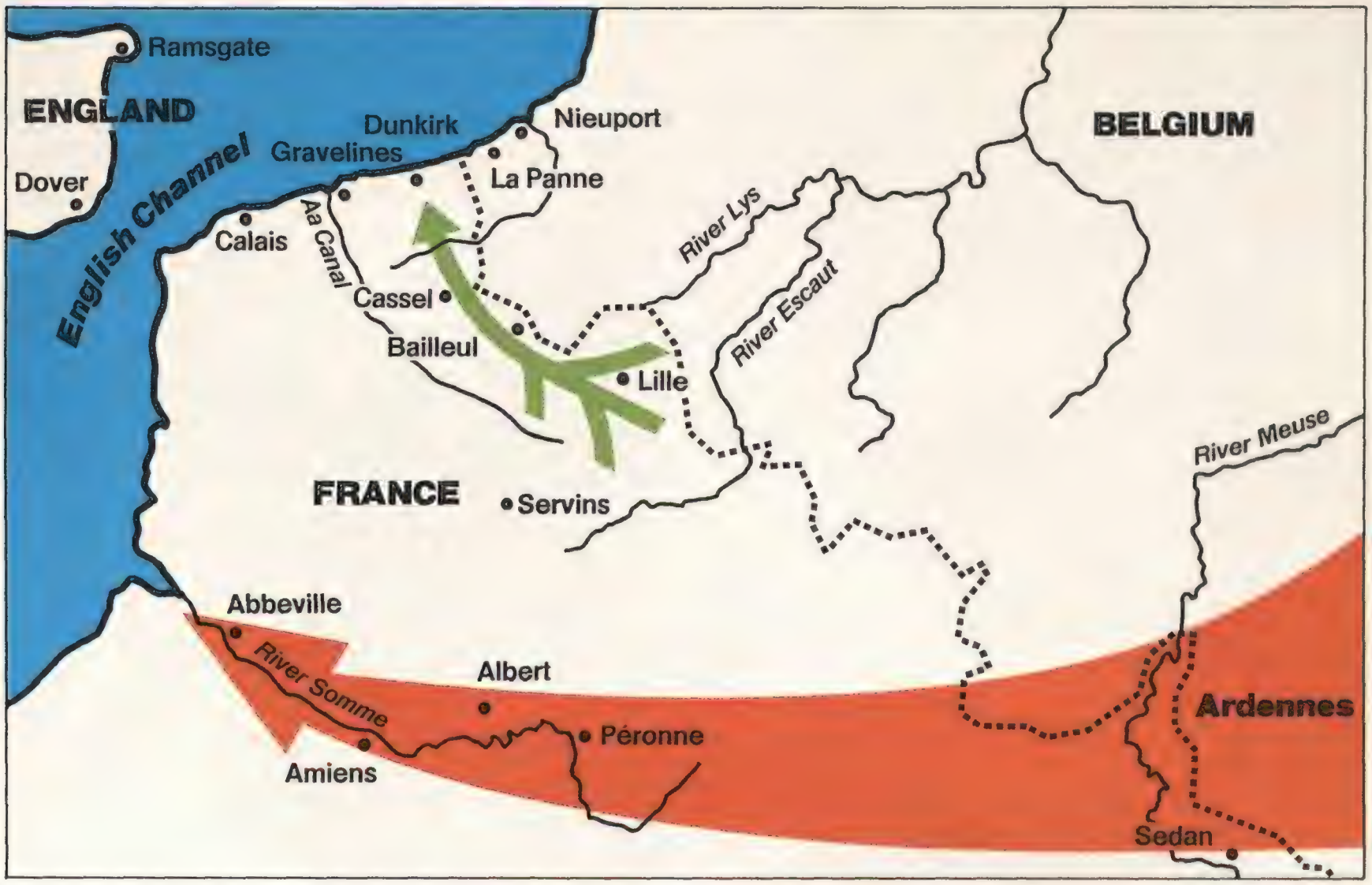
Gamelin, meanwhile, had been replaced by Gen. Maxime Weygand, who was said to be full of spirit. He issued a stirring "Operation Order No. 1," calling on the northern armies to keep the Germans from reaching the sea—ignoring the fact that they were already there.

Belgian troops were sitting in cafés

On May 25 reports began coming in that the Belgian line was cracking where it joined the British. If it went, the German army groups would link up, and the BEF would be finished. The 12th Lancers reported that the enemy had punched through the Belgian line on the River Lys. A liaison officer said the Belgians on his front had stopped fighting completely; they were sitting in cafés.

By 5 P.M. Gort had heard enough. His decision: evacuate. London was also going through some soul-searching. Eden telegraphed Gort at 4:10 the next morning that the safety of the BEF must come first: ". . . only course open to you may be to fight your way back to west where all beaches and ports east of Gravelines will be used for embarkation."

But *could* they evacuate? The BEF and French First



German troops swept through "impenetrable" Ardennes Forest to the sea at Abbeville. Squeezed into a narrow corridor by German drive, Allied troops attempted to withdraw toward Dunkirk.

Army were squeezed into a corridor 60 miles deep, 15 to 25 miles wide, running inland from the sea. Most of the British were concentrated around Lille, 43 miles from Dunkirk; the French still farther south. Churchill thought 20,000 or 30,000 men might be rescued. But he had a streak of pugnacious optimism. He and Eden had once met at Cannes and won at roulette by playing No. 17. Now he suddenly turned to Eden and observed, "About time No. 17 turned up, isn't it?"

The men of Guderian's 1st and 2nd Panzer Divisions had reached Abbeville so quickly that bewildered French civilians thought that these blond, dusty warriors must be Dutch or English. The panzers' mission was to seize the Channel ports, sealing off any chance of Allied escape. Their advance units had reached the Aa Canal, a crucial part of the "canal line" the British were trying to set up to guard their right flank. Around midnight of May 23 the 1st Panzer stormed across the canal. By morning three more bridgeheads were in hand. German spirits were sky-high. Prisoners poured in, and the spoils of war piled up.

From his headquarters train, Hermann Goering, beefy marshal of Hitler's air force, followed the dash of the panzer divisions with mounting concern. These dramatic tactics were robbing his Luftwaffe of its proper share in the coming victory. On the afternoon of May 23, he bellowed, "I must speak to the Führer at once. Get me a line!"

Goering struck all the right chords. For days the Führer had been growing ever more nervous about the safety of his armor. The shadow of World War I hung over him: France was the real enemy, Paris the real target. In that last war, the French capital had dangled just out of German reach for four years—it must not happen again. Faced with the choice of using his tanks to throw nine already shattered British divisions into the sea, or saving this armor to hurl against 65 fresh French divisions blocking the road to Paris, Hitler welcomed Goering's appeal to use the Luftwaffe.

In this state of mind, on May 24 Hitler consulted with General von Rundstedt, who had stopped the panzers so the rest could catch up. Rundstedt suggested that the infantry should continue attacking, but the panzers should hold fast on the Aa Canal and simply gather in the BEF as it was driven back by infantry from the other side of the pocket. Hitler approved. New orders went out, halting the armor.

'Allied troops swarmed up the corridor toward Dunkirk. They couldn't miss it: just head for that column of smoke'

Waiting for rescue, thousands of Allied troops wind seaward on beaches from Dunkirk to La Panne.

"We were utterly speechless," Guderian later declared. Four panzer and two motorized divisions had arrived at the Aa; six bridgeheads had been planted; advance patrols were meeting little opposition; just over the horizon lay Dunkirk. Why stop now? General von Brauchitsch, Chief of the Army high command, went to Hitler to argue his case. On the 25th, appeals were made by other generals—all turned down cold.

But by May 26 the Luftwaffe had not lived up to Goering's promises. Behind-the-scenes telephone calls urged that tanks get moving again. That afternoon the halt order was lifted. Panzer crews were alerted, fuel tanks topped off, ammunition loaded, columns reassembled. All this took 16 hours; it was not until the predawn of May 27 that the advance was finally resumed. For Churchill, No. 17 had come up—an unexpected windfall. By the time Hitler lifted the halt order, tough, seasoned Allied troops held all the key towns on the western side of the escape corridor. On the eastern side, two fresh divisions joined four already in place. All the way south, the French First Army still blocked the enemy advance at Lille.

Within the narrow passageway, more than 150,000 troops swarmed toward the coast. From east and west two streams merged into a turbulent river of men. The Stukas pounded them. One spotted a dispatch rider. Machine guns blazing, the plane made two passes as the rider weaved wildly on his motorcycle. Still after him, the Stuka climbed, peeled off and dived straight at him. This time the pilot misjudged and plunged into the road, exploding in a ball of fire. The rider turned into a field, smoked a cigarette and carried on.

Numbed by Stuka attacks and lack of sleep, men lost all sense of time and place. Days merged; towns lost identity. But at Gort's headquarters, Colonel Bridgeman, acting Operations Officer, had been developing an evacuation plan and contemplating the problem of defending the flat countryside. Cassel was the place that *must* be held while the BEF scrambled up the corridor to Dunkirk. After that, it would be the Navy's job to get them home.

At Dover, Vice Adm. Bertram Ramsay, in charge of evacuation, realized that the battlefront was changing faster than meetings could be held. Improvisation was the order of the day. Ramsay did not suffer fools gladly, and expected his officers to show initiative. One had waged a battle to get a telephone connection with Boulogne, Calais and Dunkirk—now a priceless asset.

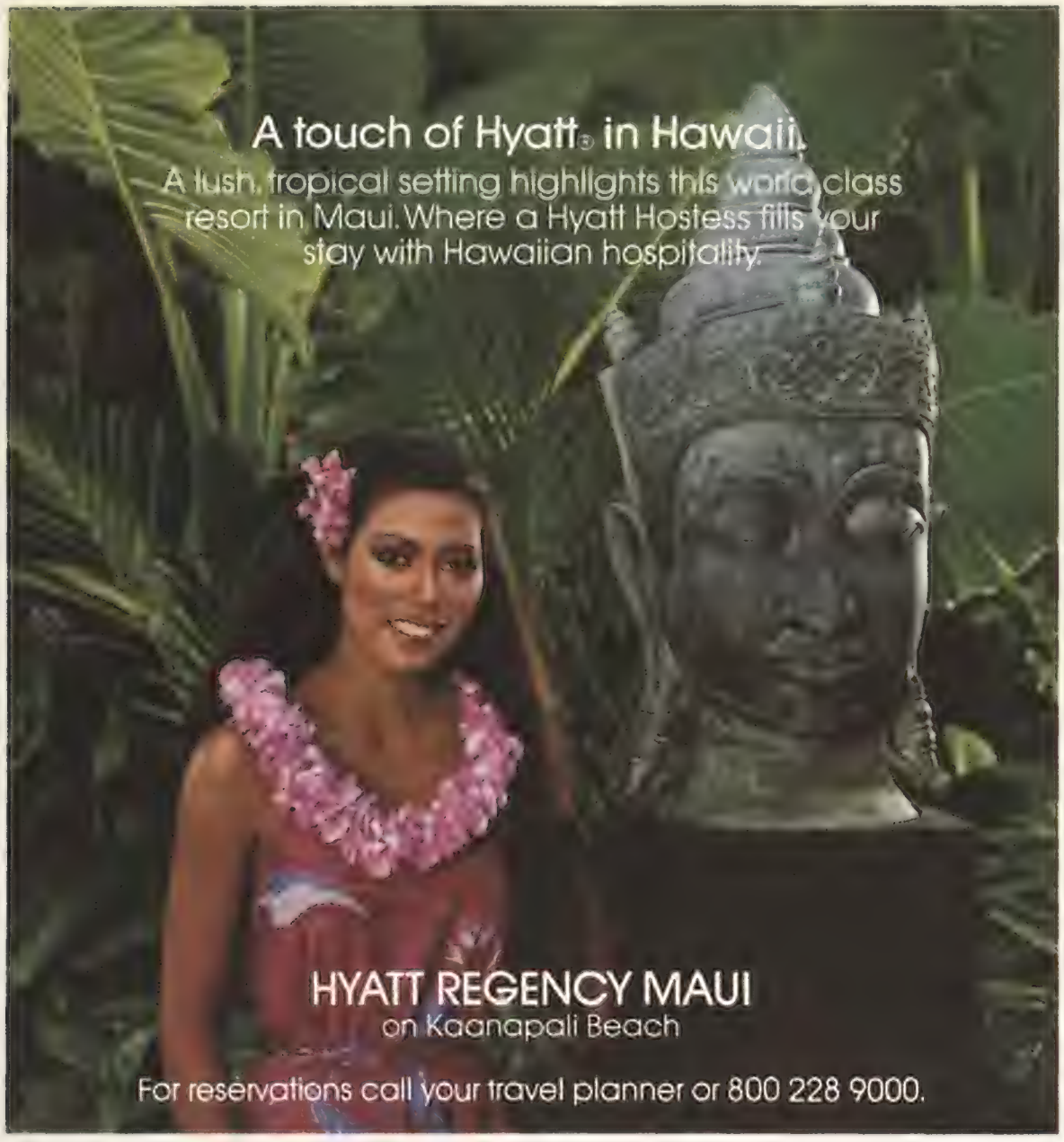
Ramsay lived and worked at Dover Castle, but his office was *under* the castle, in the famous chalk cliffs. The biggest room was a large gallery that had once housed an emergency power system. Here, in the "Dynamo Room," Ramsay's staff organized "Operation Dynamo," as the evacuation came to be called.

Working at a huge table with a battery of phones, the staff had practically a blank check to draw what he needed—destroyers, special trains, tugs, medical supplies, ammunition, rations, spare parts, rope, diesel fuel, men.

Some 50 Dutch barges, self-propelled craft of 200-500 tons, had escaped across the Channel. These *schuitjes* would be ideal for working the beaches off Dunkirk. The British could not master *"schuitje,"* so the barges were called "skoots." Little ships would be important for evacuation from the gently shelving Flemish beaches. Messages flew all over England. Mechanics had to be found who understood balky engines. Charts were needed. A colonel toured London's travel agencies collecting brochures that might describe French beaches in some detail.

Meanwhile, the Allied troops swarmed up the escape corridor toward the sea. In a Belgian village, a British sergeant was awakened by voices shouting, "Get on parade!" He heard marching feet, looked out and saw his unit stepping off to the vehicle park. Catching up, he learned that the orders were to smash the cars and motorcycles and go to Dunkirk. They couldn't miss it: just head for that column of smoke.

There were women in the great trek. Jeanne Michez had married Staff Sgt. Gordon Stanley in February—the first French girl to wed a member of the BEF. When "the balloon went up," she had gone to her mother's home in Servins. Suddenly one afternoon Stanley appeared with a staff car. The Germans were coming, he told her. Jeanne flung a few things into a suitcase. In an hour she was ready, dressed as if she were taking the afternoon train to Paris—blue dress, blue coat, matching blue broad-brimmed hat.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Shot up at Dunkirk, pilot Michael Lyne ditched on a fashionable British beach.

Off they went, the two of them up front and a corporal in back. They spent the first night in the car, other nights mostly in some ditch. Once they slept in the barn of a Belgian farmer. He wouldn't give them permission, but Gordon shot off the barndoor lock, and they settled in, anyhow. They got dirtier and dirtier. Once Jeanne managed to buy a bucket of water for ten francs, but mostly there was no chance to wash. The broad-brimmed hat crumbled and vanished—one more addition to the litter of war.

At the little French town of Bailleul they stopped at the house of an elderly spinster, Mlle Jonkerick. Unlike many people they met, she was all hospitality. Jeanne was exhausted, her clothes in shreds. She told Gordon it was no use; she couldn't go on. Gordon was a soldier; he had his duty; she understood that. Still, it was a hard moment. He promised to return for her in two months. It took him five years.

The smoke that towered over Dunkirk, some 25 miles to the north, indicated that Hermann Goering was trying to keep his promise that the

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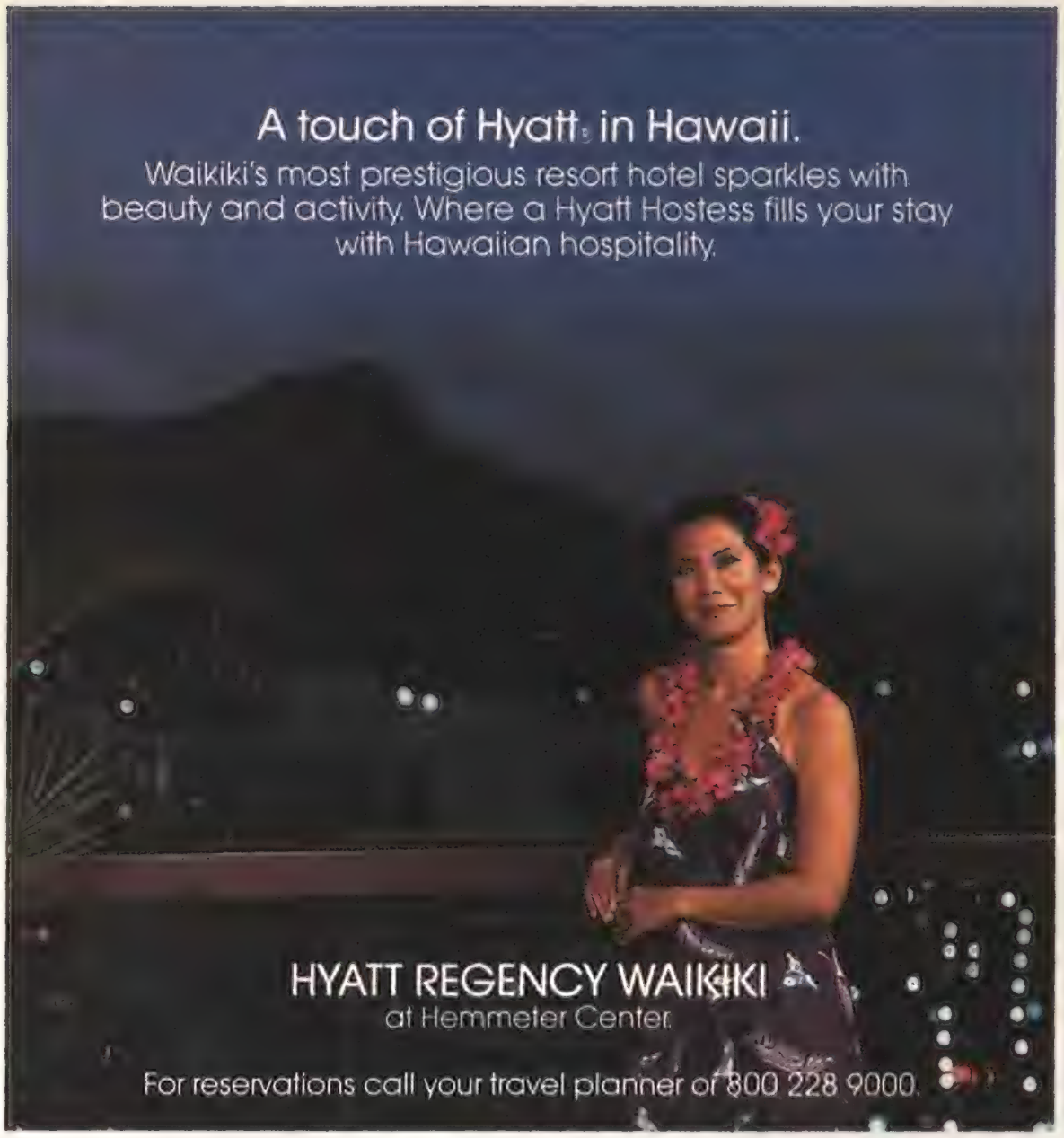
Lyne today recalls feeling like a blood-smeared intruder after landing.

Luftwaffe could win the battle alone. For nearly a week the Heinkels, Dorniers and Stukas of Luftflotte 2 had been pounding the town.

"Where is the RAF?" The cry went up again and again. Yet the RAF was there, although so far not very effective. Fighter Command had been shifting its hoarded squadrons to airfields close to the Channel. For Michael D. Lyne, a young flying officer, it was a sobering change. On his first patrol over the beaches he met Stukas and Me 109s. In the afternoon, off Calais, spirals of smoke whisked past his wings, and it dawned on him that he was somebody's target. Trying to maneuver, he stalled, then spun as a bullet hit his knee. The cockpit filled with fumes, his engine quit.

His first thought was to crash-land in France and spend the rest of the war in a POW camp. On second thought, he decided to splash down in the Channel, but "I didn't want to get wet." He decided he might be able to nurse the plane back to Britain.

He made it—barely. Gliding in a few feet above the sea, he crash-landed on the shale beach at Deal in a cloud of flying pebbles. Bloody and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Aladdin.

oil-soaked, he staggered from the cockpit. It was Sunday, and Deal beach was filled with strolling couples—military men in dress uniforms, girls in their frilliest spring creations. Barging into this dainty scene, Lyne felt he was an unwelcome intruder.

At 6:57 P.M. this same Sunday, the Admiralty signaled Dover: "Operation Dynamo is to commence." Admiral Ramsay had 129 ferries, coasters, skoots and small craft to do the job, but more were on the way and the staff in the Dynamo Room was clicking smoothly.

Troops were approaching Dunkirk in every way imaginable—members of the 1st East Surreys on borrowed bicycles, a farm boy in the 5th Royal Sussex riding a giant Belgian cart horse, a hatless Brigadier tramping alone. Just outside Dunkirk an artilleryman saw one fellow sweep by on roller skates, carrying an umbrella.

They swarmed onto the beaches, lost, confused, all too often leaderless. Some took shelter in cellars as the bombs crashed down. Others threw away their arms and wandered about the beach. Others played games and swam. Others got drunk. Others prayed and sang hymns. Others settled in deserted cafés and sipped drinks like tourists. One man, with studied indifference, stripped to his shorts and sunbathed among the rocks, reading a paperback.

Mishaps and misunderstandings explain why only 7,669 men were evacuated on May 27. German guns shelled the rescue fleet, turning some ships back. Others stood offshore, slowly lifting men from the beaches. The pace quickened when the rescuers began using the eastern mole, a long breakwater sticking out from Dunkirk harbor. Even so, more ships were needed—destroyers to fight off the Luftwaffe, small craft to ferry troops to larger vessels in deeper water. Messages to Dover urged more small boats.

At Tough Brothers boatyard in Teddington, Douglas Tough got an early morning phone call from an admiral, explaining the problem. The admiral could not have called a better man. The Tough family had been in business on the Thames for three generations. Douglas knew just about every boat on the river. He was willing to act for the Admiralty, commandeering any suitable craft.

The first 14 were already in the yard, and workmen swiftly off-loaded

Jeanne Stanley (seen today at right), tried to flee with BEF husband.

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Adm. Bertram Ramsay, planner of rescue, takes a break from the Dynamo Room.

cushions and china, ripped out peacetime fittings, filled the fuel tanks. Tough went up and down the river, picking out additional boats.

Volunteer crews were being assembled—mostly amateurs who would get the boats down the river to Southend, where the Navy would presumably take over. The Admiralty's Small Vessels Pool did not confine its efforts to Tough's. It tried practically every boatyard and yacht club from Cowes to Margate.

Robert Hilton, a physical education specialist, and Ted Shaw, a redheaded cinema manager, teamed up to bring a motorboat down the Thames. They expected supplies at Ramsgate, but all they received were two cans of water—without even a tumbler for it. They went to a pub, had a drink and pocketed the glasses. Hilton and Shaw eventually reached the beaches and transferred to a skoot. They were assigned the task of picking up soldiers with its lifeboat.

All the while the Allied troops continued streaming up the escape corridor. A French tank company, separated from its regiment, joined the 1st Royal Irish Fusiliers. The tank crews bristled with discarded British, French and German weapons and were literally festooned with bottles

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of wine. They fought with tremendous élan, roaring with laughter and pausing to shake hands with one another after every good shot. When the Fusiliers were finally ordered to pull back, the tankers decided to stay and fight on. "*Bonne chance!*" they called after the Tommies.

To Capt. Wolfgang Falck of the Luftwaffe, these would always be "the golden days." As a *Gruppe* commander in Fighter Squadron 26, he flew an Me 110, a new twin-engine fighter said to be better than the fabled Me 109. No one really knew because there was so little opposition.

The only problem was keeping up with the panzers. As the army advanced, so did the squadron, and it required superb organization to keep fuel, spare parts and maintenance flowing. The administrative officer had a nose for decent billets with good wine cellars. Falck forbade looting, but there was no rule against enjoying life. The pilots found themselves eating off Limoges china and sleeping in canopied beds.

May 27 brought the first inkling that the Luftwaffe's golden days would not last forever. Now the target was Dunkirk, and as the Heinkels and Stukas went about their business, modern British fighters—Hurricanes and Spitfires—stormed down upon them, breaking up formations, sending occasional bombers spinning down. These British squadrons had been considered too valuable to base in France, but the fighting was in range of England now. Taking off from a dozen Kentish fields, they poured across the Channel.

Captain Falck discovered that the Me 110 was *not* better than the 109—in fact, it was not as good. Even the 109s had met their match. Spitfires could hold a dive longer, come out faster and turn sharper. Happily for the Luftwaffe, there were never enough Spitfires and Hurricanes, for RAF Fighter Command had to think ahead to the coming defense of Britain herself. Air Chief Marshal Sir Hugh Dowding refused to allocate to Dunkirk more than 16 squadrons at a time. This was not enough for full-time cover, and the Luftwaffe struck when the beaches were without it.

On May 28 the weather turned sour and Fliegerkorps VIII, respon-

Dunkirk's eastern mole survived bombing to handle thousands of troops. Here a long line waits patiently for a rescue ship.

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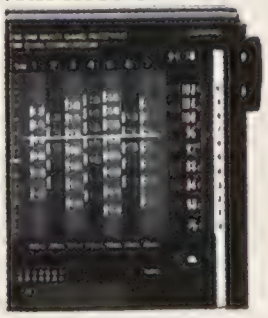

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Shoulder-deep, Tommies wade out to rescue vessel standing off the beach.

sible for Dunkirk, remained on the ground. May 29 dawned even worse, but around noon it started to clear up, and soon planes began taking off. Some 400 aircraft headed for Dunkirk. By 3 P.M. they were there—and no sign of the RAF. A Stuka gunner-radio operator looked down on ships crowded together at the eastern mole and could barely imagine a more inviting target.

Down on the mole, Lt. Robin Bill, commanding six trawlers, could see the bombs tumbling out of the diving Stukas and threw himself face downward. One bomb landed 20 feet in front of him, hurling concrete slabs into the air. A chunk sailed by his ears and killed a soldier farther down the walkway. Shaken and covered with dust, Bill felt something oddly moist. It was a puppy licking his face.

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The destroyer *Jaguar* managed to cast off, packed with troops. Shrapnel riddled her, slashing open fuel tanks and steam lines. *Jaguar* lost headway and drifted toward shore. The destroyer *Express* towed her clear and took off troops. At the mole it was the destroyer *Grenade*'s turn. One bomb landed aft, another on the bridge, exploding in an oil tank below. A great sheet of flame shot up through the deck. Somebody's tin hat —turned red hot—rolled crazily around on its rim. *Grenade* was towed away, burned for hours, then blew up.

Able Seaman P. Cavanagh scrambled from the burning *Grenade* onto the mole just before she cast off. A German plane swooped down, machine-gunning the troops that crowded the walkway. A soldier pushed Cavanagh down, then lay on top of him. When the plane had gone, Cavanagh asked the man to get off, but the soldier was dead.

Cavanagh now went aboard *Fenella*, a large wooden steamer. A bomb landed alongside, splintering the hull. Cavanagh hopped off, crossed the mole and decided to try a trawler. Before he could climb aboard a bomb landed on her, and she went down at her berth with stately dignity, funnel and masts above water, flag still flying. Cavanagh moved to another trawler, and this time nobody dropped anything on him. He sat on the deck for a moment's rest. "Get off your arse and give us a hand," someone called, and he went wearily back to work.

The Dynamo Room remained blissfully ignorant of these events. As far as the staff knew, the evacuation was proceeding smoothly. The roof fell in when a destroyer, sent to Dunkirk, wired Dover: "Continuous bombing for 1½ hours. One destroyer sinking, one transport with troops on board damaged. . . . Impossible at present to embark more troops."

The Admiralty had more than Dunkirk to think about: there were the convoys, the Mediterranean, the protection of Britain herself. The First Sea Lord, Adm. Sir Dudley Pound, reluctantly decided to withdraw the eight modern destroyers Ramsay had left, leaving him with only 15 older vessels.

Lt. James M. Langley, 2nd Coldstream Guards, was wounded and captured at Dunkirk. He escaped and is now co-author of a recent book, *MI 9*.

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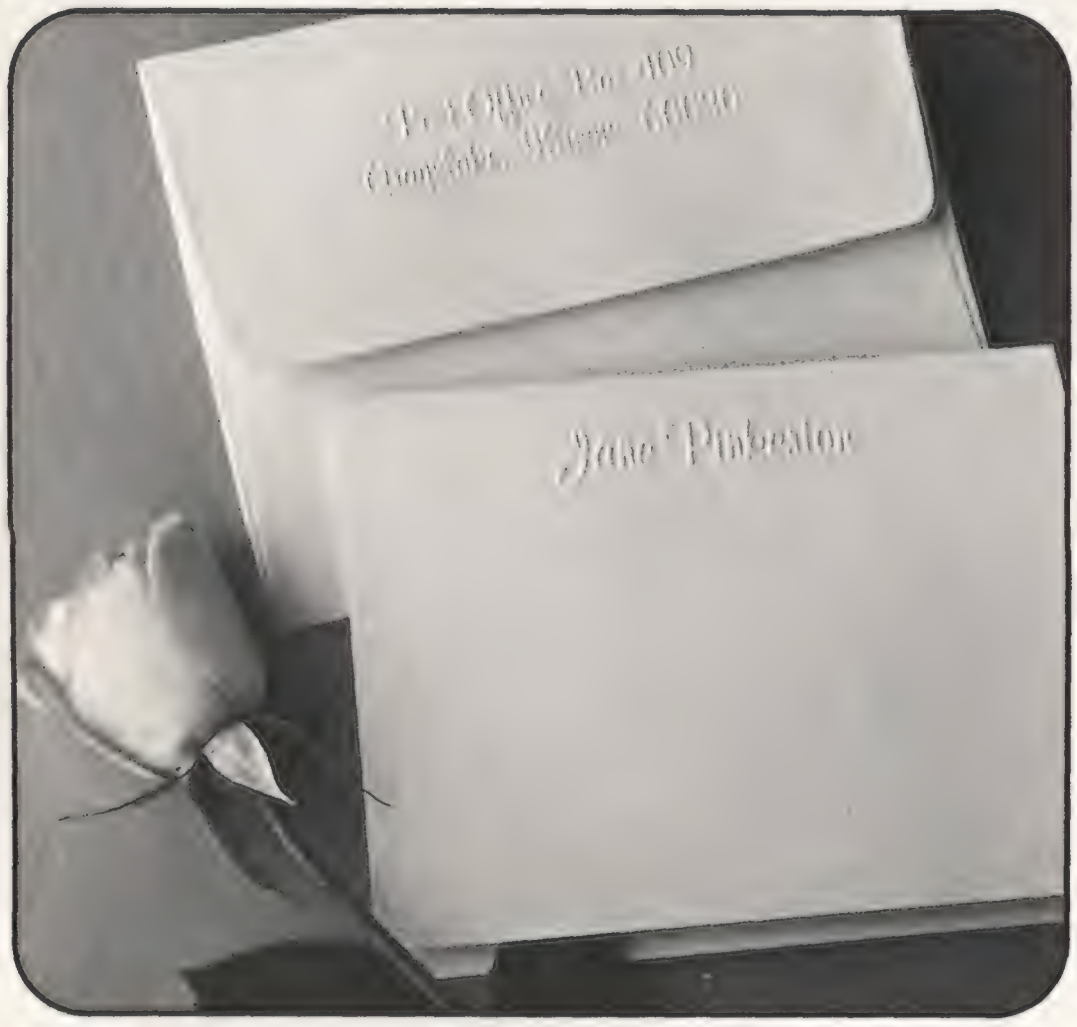

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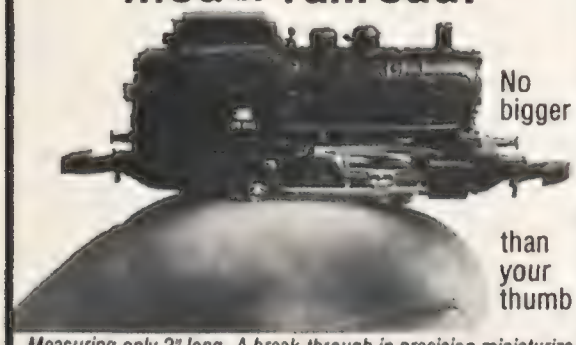

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summer home. And it was linked by telephone with London.

The men at Cassel, 19 miles south of Dunkirk, had held up the Germans for three days while thousands of Allied troops scrambled up the corridor. Now they had orders to pull back, but it was too late. The enemy had seeped around the town and it was cut off. Brigadier Somerset, commanding the garrison, decided to try to escape after dark.

It was no use. The Germans were everywhere. The 4th Oxfordshire and Buckinghamshire were overwhelmed; the East Riding Yeomanry were virtually wiped out. The 2nd Gloucesters were trapped in a thick wood. *"Kamerad! Kamerad!"* shouted the Germans, trying to flush them out. The Tommies lay low. A pause, then a voice speaking good English over a loudspeaker: "Come out! Come out! Hitler is winning the war, you are beaten. Come out, or we will shell you out."

Second Lt. Julian Fane of B Company was not about to buy that. He had heard of another British battalion that listened to such a broadcast, threw down its arms and came out—to be machine-gunned. He and his men decided to fight it out.

Darkness at last. The little group continued north, keeping as silent as possible, using every bit of cover. Then a red Very light suddenly soared into the night, and machine guns, mortars, rifles opened up on them. They had been ambushed. Tracers crisscrossed the sky; a haystack burst into flames, illuminating the group perfectly. Men were falling on all sides, and Fane was hit in the arm and shoulder. He reached a ditch where he collected about a dozen others. They crept off into the darkness, managing to work their way around the Germans. Fane's little band was all that remained of the 2nd Gloucesters.

One British soldier outside the perimeter remained very much in the fight. Pvt. Edgar G. A. Rabbets had been just another Tommy in the 5th Northamptonshires until a fire fight

Much-decorated Robin Bill was barely missed by a bomb on the eastern mole. Today Bill recalls a puppy licking his face after the air raid.

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Sgt. Bill Knight evaded capture by joining up with a German truck convoy.

during the great retreat, when Rabbets took a potshot at an enemy soldier about 200 yards away. The man dropped in his tracks.

"Can you do that again?" asked the company commander.

Rabbets obligingly picked off another German.

Then and there Ted Rabbets was designated a sniper, to act on his own. He had no previous training, but he had once known a poacher who taught him to move so quietly he could "catch a rabbit by the ears," and make himself so small he could "hide behind a blade of grass."

Rabbets managed to survive alone most of the way across Belgium, usually deep in German-held territory. Sometimes he matched wits with his German counterparts. One German sniper fired at him from a hole in a roof and missed by six inches. Rabbets fired back and saw the man plunge out of the hole. Ultimately he reached the coast and worked his way west, still dipping into German lines on forays. On May 31 he rejoined the BEF, perhaps the last

Now retired, Knight runs this branch of vets association from his Sussex home.

fighting man to enter the perimeter.

The day before, as the destroyer *Malcolm* was bringing her third load of troops toward Dover, her first lieutenant experienced a moment he would never forget. Coming over the horizon was a mass of dots. They materialized into vessels—fishing smacks, drifters, excursion boats, glittering yachts, mud-spattered hoppers, open launches, tugs towing lifeboats, Thames sailing barges, cabin cruisers, dredges, trawlers, rust-streaked scows and an admiral's barge with tassels and fancy ropework. The lieutenant turned to a chief boatswain's mate and burst into the Saint Crispin's day passage from *Henry V*: "And gentlemen in England, now a-bed,/Shall think themselves accurs'd they were not here."

The trickle of small ships that began in Tough's boatyard was turning into a deluge. There was still no announcement of the evacuation, but England is a small place. One way or another, word reached those who were needed. Capt. Lemon Webb was nursing the spritsail barge *Tollesbury*

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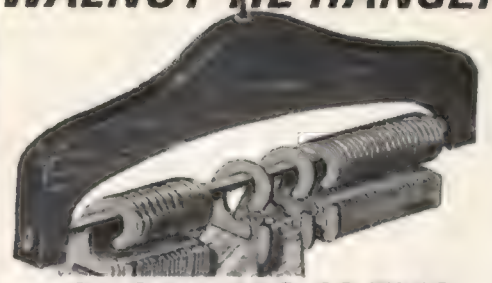
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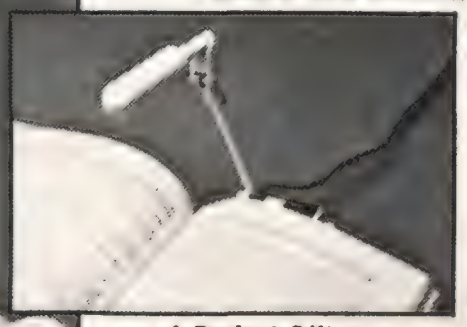
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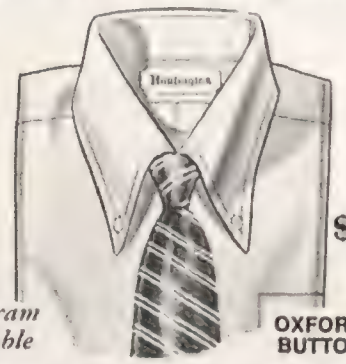

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up the Thames when a motorboat eased alongside and a naval officer ordered him to a nearby jetty. *Tollesbury* was soon on her way to the Thames estuary. The crew of the Margate lifeboat *Lord Southborough* were playing darts at their favorite pub when a message came. Within hours they were heading for Dunkirk.

The cockle-boat fleet of Leigh-on-Sea lay at anchor when the call came, and the civilian crew volunteered to a man. Ken Horner, 17, was considered too young and was left behind, but he ran home, got his mother's permission and bicycled off in pursuit of the fleet. He caught up with his boat at Southend.

At 10 P.M., May 29, the first convoy of little ships set out from Ramsgate across the Channel. At 1 A.M. another convoy—19 launches—left, and from then on the flow steadily increased. By late afternoon, May 30, it was hard to tell where one convoy ended and the next began. All that night and the 31st too, they poured across a smooth carpet of sea. The English Channel behaved for days. Best of all, heavy mist gave the Luftwaffe no chance to follow up the devastating raids of the 29th. The greatest peril was the surf at the beach. Even when the troops behaved perfectly, the boats were in danger of capsizing.

Among those departing this day was General Gort. Against his will, he was taken home by the Navy, arriving at Victoria Station all but unnoticed amid the bedraggled soldiers.

Of the troops still holding the perimeter, the 2nd Coldstream Guards defended a segment of the line along the Bergues-Furnes Canal. Lt. Jimmy Langley waited in a cottage he had fortified and stocked with provisions. He had no idea when the British planned to pull out. In the first light of the new day, June 1, Langley looked through a peephole. A thick mist hung over the canal and the flat meadows, but at sunrise it burned off. On the other side of the canal stood a working party of Germans, perhaps 100 of them, armed only with spades. A blaze of gunfire from the cottage mowed them down.

The firing increased as the enemy troops joined in. Around noon they stormed across the canal. The 1st East Lancashires barely held them off. To their left were the 5th Borderers. If they collapsed, the 2nd Coldstream would be hit next. An officer from the Borderers hurried to Major McCorquodale at the Coldstream command

French destroyer *Bourrasque* goes down after striking a mine. Desperate troops leaped for their lives, but 150 were lost in the water.

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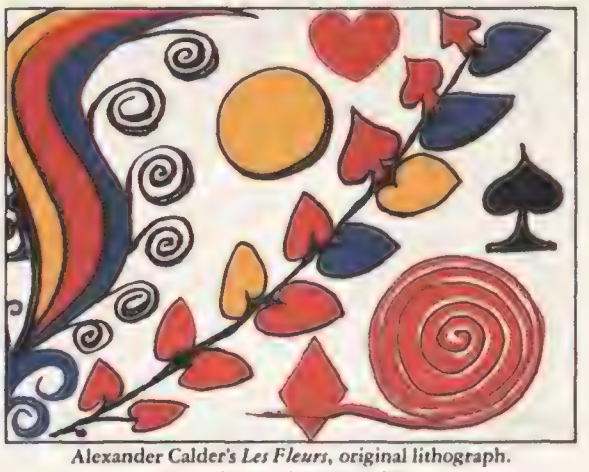

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Pet-loving Tommies adopted dogs. Some 170 were brought back to Dover.

post to warn that his battalion was about to withdraw.

"I order you to stay put and fight it out," the Major answered.

"You cannot do that. I have overriding orders from my colonel to withdraw when I see fit."

McCorquodale saw no point in arguing. "You see that big poplar tree on the road? The moment you or any of your men go back beyond that tree, we will shoot you."

The Borderer officer went off, and McCorquodale turned to Langley. "Get a rifle. Sights at 250. You will shoot to kill the moment he passes that tree. Clear?"

McCorquodale picked up a rifle himself and the two sat waiting, guns trained on the tree. Soon the Borderer officer reappeared with two men. They paused, then the officer moved on past McCorquodale's deadline. Two rifles cracked at the same instant. The officer fell, and Langley never knew which one of them got him.

Such measures were not enough. The 5th Borderers fell back. Jimmy Langley's cottage came under fire. The afternoon turned into a jumble of incidents: knocking out a German gun . . . washing down a delicious chicken stew with white wine . . . using the Bren guns in the attic to set three German lorries on fire . . . an old lady appearing from nowhere, begging for shelter; Langley told her to go to hell, then, overcome by remorse, put her in a back room.

Suddenly a crash, a shower of tiles

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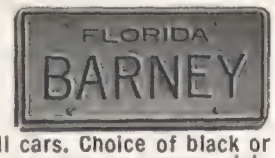

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and beams, a blast of heat. In the choking dust, Langley heard a small voice say, "I've been hit"—then realized it was his own.

It didn't hurt yet, but his left arm was useless. A medic appeared. He was gently carried down, put in a wheelbarrow and trundled to the rear —one of the few Coldstreamers small enough to make an exit this way.

Covered by the French, British units converged on Dunkirk all through the night of June 1-2. The 2nd Coldstream reached the harbor late. The men were bone-tired, but they still had their Brens. As they moved down the paved promenade, they marched in perfect step, arms swinging. "I'll bet that's the bloody Guards," called a caustic voice in the dark. "Try marching on tiptoes!"

Langley, groggy from his wounds, was vaguely aware of an ambulance ride that seemed to take forever. Blood kept dripping onto his face from the man above him. At last the ambulance stopped, and his stretcher was lifted out. "This way," somebody said. The stretcher party reached water's edge. A ship's lifeboat lay waiting. An officer in a naval great-coat came over.

"Can you get off your stretcher?"

"No, I don't think so."

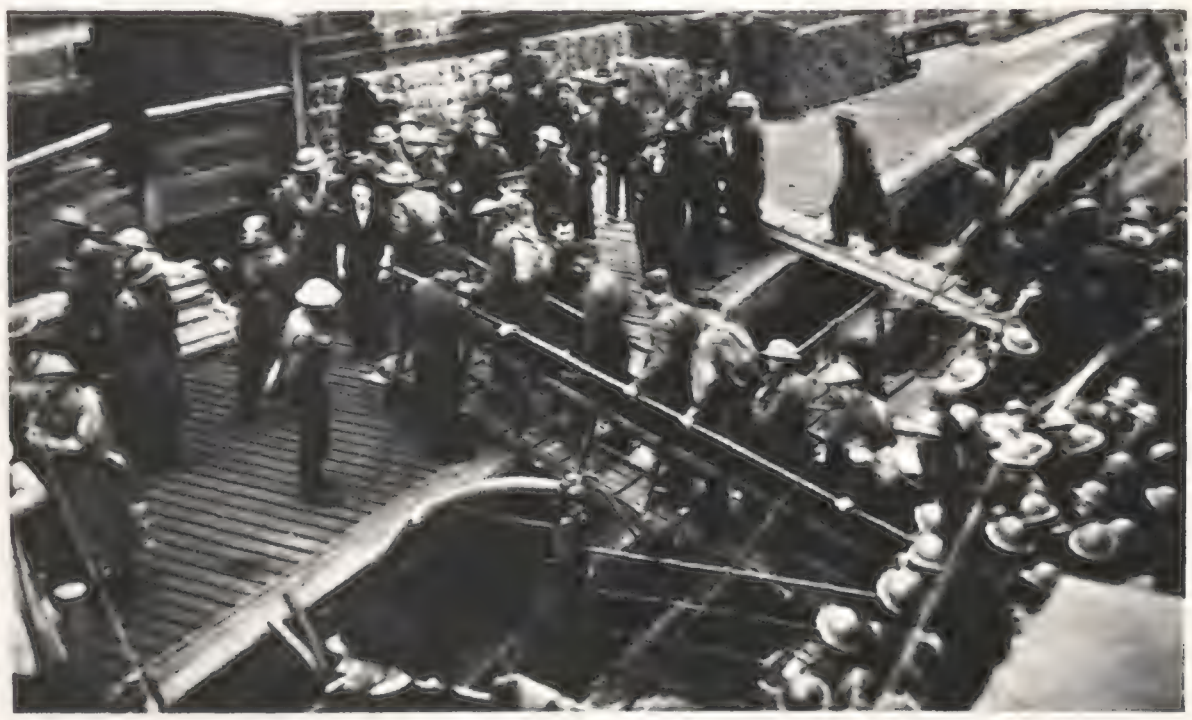
"Well, I'm very sorry. We cannot take you. Your stretcher would occupy the places of four men."

Langley said nothing. The bearers carried him back to the ambulance.

Sunday, June 2. Some men joined a chaplain celebrating Holy Communion on the beach. There was an impromptu soccer game and motorcycle races in the sand. Most of the troops crowded into any place that seemed to offer shelter. Headquarters of the 5th Green Howards was established at a comfortable house a block from the beach. Here the battalion adopted a stray French soldier who made right for the kitchen. He soon produced a superb stew of beef and wine. Promptly christened "Alphonse," he was made an honorary member of the battalion.

The Green Howards offered something rare at Dunkirk: a sizable body of organized troops. Their commander decided they would form a cordon to control traffic and ensure an orderly flow of men the coming night. Those selected would be last off and might well be left behind. The officers drew lots for the honor.

Plans for the evening were moving ahead at Dover. There were plenty



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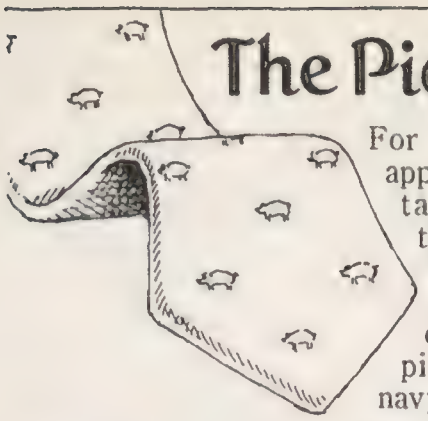

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Victorious German infantrymen stack arms, and rest in captured Dunkirk. Their quarry was gone.

of ships on hand for what Ramsay called a "massed descent" on Dunkirk. Embarkation to start at 9 P.M. and continue until 3 A.M. The plan provided for enough large ships to lift 37,000 men. The French would be using their own ships to lift troops.

Shortly after 9 P.M. the last of the BEF started down the mole. The 2nd Coldstream filed aboard the destroyer *Sabre,* still proudly carrying their Bren guns. The Green Howards dissolved their cordon and joined the parade. In the midst of the crowd walked two high-ranking officers carrying a suitcase between them. Gen. Harold Alexander, commander of the last army corps to leave, was on his way home with a staff officer. They were taken out to the destroyer *Venomous,* where Cmdr. John McBeath was asked if he could handle "senior officers and staffs." McBeath welcomed them. His lieutenant reported a few minutes later that he had put them with a few aides in McBeath's cabin, "but I'm afraid one of the colonels has hopped into your bed with his spurs on."

Sergeant Bill Knight of the Royal Engineers missed getting away with the last of the BEF, but an idea occurred to him. Why not go the other way, slipping through the encircling German Army to rejoin the Allies on the Somme? With the help of two Belgian civilians, Knight and four men from his unit used back roads, and even fell in behind a German convoy of captured vehicles. When the motorcycle escort dropped back to check up, Knight slowed down to appear to be no part of the convoy. When the motorcycle went back to the front, Knight closed up again. They made it to Allied lines in just two days.

By midnight, June 2, the eastern mole was almost deserted. The British had gone, and most of the French were still manning the perimeter.

"Now, sub," said Lt. E. L. Davies, captain of the paddle-sweeper *Oriole,* "I want 700. Go and get them." He was talking to his sub-lieutenant, Rutherford Crosby, as the two of them were standing on the mole wondering where everybody was. Crosby headed shoreward and at last reached

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Dunkirk today is a busy port with fine beaches, holidaymakers and few signs of the grim spring of 1940.

a mass of French troops. "*Venez ici, tout le monde!*" he called, gesturing.

The way back led past another ship, and her crew tried to entice Crosby's group into their vessel, like carnival barkers at a country fair. The rule was "first loaded, first away," and nobody wanted to hang around Dunkirk any longer than necessary. Crosby made sure none of his charges strayed—let the other crews find their own Frenchmen. It was about 2:30 A.M. on June 3 when the first of them began filing onto the mole—and most of the ships had gone back to Dover. There were no plans to return the following night. Weygand fired off a telegram to London, urging that the evacuation continue another night to embark the 25,000 French troops who were holding off the Germans. Churchill wired back: "We are coming back for your men tonight." Ramsay signaled his command that the work was not finished.

On the destroyer *Malcolm*, back from her seventh trip to Dunkirk, everyone assumed that the operation was over. Breakfast in the wardroom was a merry affair. Then the crew was assembled by the captain for an important announcement. He came quickly to the point: "The last of the BEF was able to come off because the French took over the perimeter last night. Now the French have asked us to take them off. We can't do anything else, can we?"

No. But it was still a shock. The wardroom had planned a festive mess that evening, and decided to dress anyhow. When *Malcolm* sailed on her eighth trip to Dunkirk, her officers were wearing bow ties and monkey jackets.

On this last night of evacuation, 26,989 French troops were taken off, but thousands still remained at Dunkirk. Among them was Jimmy Langley, lying wounded at the 12th Casualty Clearing Station. He watched a small party of German infantrymen enter the grounds and half expected they would kill him. As they walked toward him, Langley decided his best chance lay in playing the "wounded prisoner." Pointing to the Red Cross flag, he gasped a request for water and a cigarette. The leader of the squad gave him both. Then Langley asked, a little tentatively, what they would like from him.

"*Marmelade*," was the reply. For the first time Langley had hope. He felt nobody about to kill him would be thinking primarily of marmalade.

The man from Gdansk.

RUDI FREY

Unique insights into a crusade, and a crusader, perhaps guided more by hope and passion than by reason.

He seems to have sprung from nowhere, like the hero of a folk legend, summoned up by the urgency of his country's need. And like a legendary figure, Lech Walesa seems more charisma than person, a force rather than an individual.

When Poland was invaded by proxy on December 13, TIME had already chosen Walesa as Man of the Year. Writers, editors and researchers in Poland and America were at work to create a definitive word portrait of this extraordinary electrician from Gdansk.

With the sudden imposition of martial law, such a portrait became all the more imperative. And because of TIME's traditional access to world leaders, it emerged with a virtuosity that no other news magazine could have duplicated.

As told by TIME, the whole tragedy came alive on the page with astonishing three-dimensional clarity: time, place, mood, event, cause and effect. And above all, Walesa himself, in an interview that was exclusive with TIME, and in which he explained himself and his cause with wonderful idiomatic simplicity. Alternately pragmatic and philosophical, he summed up all he has done with the expressed conviction that: "I know that I exist and that people will come after me. I know another thing: I know that I will lose today, and tomorrow will be a victory."

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At 2:23 P.M., June 4, the British Admiralty announced the end of Operation Dynamo. "Had the BEF not returned to this country," General Brooke later wrote, "it is hard to see how the Army could have recovered. . . ." Britain could replace the guns, the vehicles; but the rescued troops would be the nucleus of the great armies that were to win back the Continent.

In the end, more than 338,000 Allied troops were landed in England, with another 4,000 lifted to French ports still in friendly hands.

The rescue electrified the people of Britain, welded them together, gave them a sense of purpose. Treaty obligations don't inspire men to great deeds. "Home" does, and this is what Britain was fighting for now. Volunteers Bob Hilton and Ted Shaw, who had spent 17 hours rowing troops out to the skoots, were back at Ramsgate. They were ordered to take a motor yacht to London. Joining several other boats, they wearily set off up the Thames.

The cheering began as the grimy, oil-smeared vessels passed the training ship *Discovery*, and her Sea Scouts set up a mighty shout. The noise grew louder farther upstream. Every bridge was lined with shouting people.

Hilton and Shaw delivered their boat and walked to the tube, where they parted. They never met again. As Hilton entered the train, his fellow passengers moved to the far end of the car. He had a three-day growth of beard; his clothes were covered with oil; he reeked to high heaven. Any idea he may have had that he would be treated as a hero quickly vanished. Then he reached his front door, discovered he had forgotten his keys, rang the bell. The door opened, and his wife stood there. She took one look at this tramp and threw her arms around him. He was a hero to someone, after all.

Back home at last, disheveled, dirty, beaming Tommies were showered with gifts whenever the troop trains slowed.

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Book reviews

In 'Vanity Fair'
Roy T. Matthews and Peter Mellini
University of California Press,
$45; $55 after December 31

Those with only casual interest in British subjects are probably perfectly content to gorge themselves on the Royal wedding and even more recent Royal birth. But serious readers who prefer to feed their passion for the Empire on more substantial stuff will be delighted with *In 'Vanity Fair,'* a smart, handsome and generously illustrated study that finds a spacious avenue into British social history through the eminent Victorians and Edwardians whose caricatures for nearly 50 years filled the pages of *Vanity Fair* (not to be confused with the later American magazine of the same name).

Like the class and values it represented so completely, *Vanity Fair* met its demise at the time of World War I, but not before pioneering a new style of magazine and caricature. One Victorian wag congratulated Thomas Bowles for founding such a journal "at a date when it seemed as fashionable to run a weekly sheet for one's friends as to endow a theater for one's mistress."

One wonders whether the sharpness Bowles used to define his society had anything to do with the rather unusual circumstances of his birth: his mother was an anonymous figure, his natural father a prominent man whose understanding wife helped raise young Tommy. On this particular score, Messrs. Matthews and Mellini are as delicate as Bowles himself

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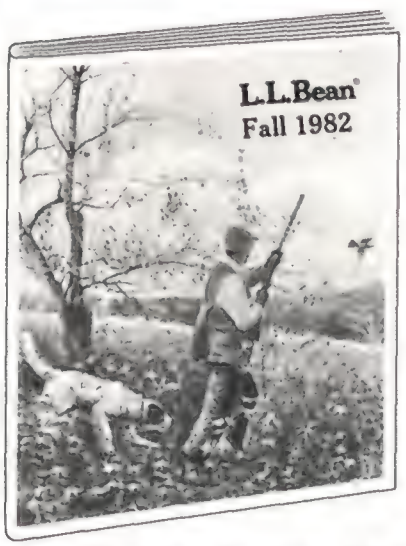

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earned himself the sobriquet of "tamed Ape" after producing a number of sympathetic caricatures that were more like portraits. But for the uninitiated, authors Matthews and Mellini are fine guides, from Disraeli (the magazine's first and much admired victim) to Joseph Chamberlain (its very last). The cognoscenti are also handily served, most notably with a complete listing of caricatures and a sleuthlike account of the fate that befell the magazine's extensive stock of them after it ceased publication.

In the book, significant caricatures are given both careful reproduction and background information. It is easy to see that Max Beerbohm's 1905 rendering of George Bernard Shaw is much finer than one by another artist that appeared in 1911. The discrepancy makes more sense, though, when we learn that *Vanity Fair* found Shaw fairly amusing in 1905, even though it noted that the English were "neither modest nor clever enough to take Mr. Shaw seriously." By 1911, Shaw had become offensive enough to rate as clever, but "certainly not so clever as he thinks." Not only are we introduced to Oscar Wilde with a revealing commentary on Ape's smart caricature of the man; there are similar presentations for

Anthony Trollope was outraged by artist Spy's view of him, published in 1873.

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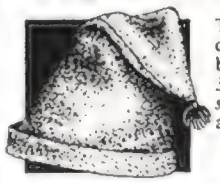

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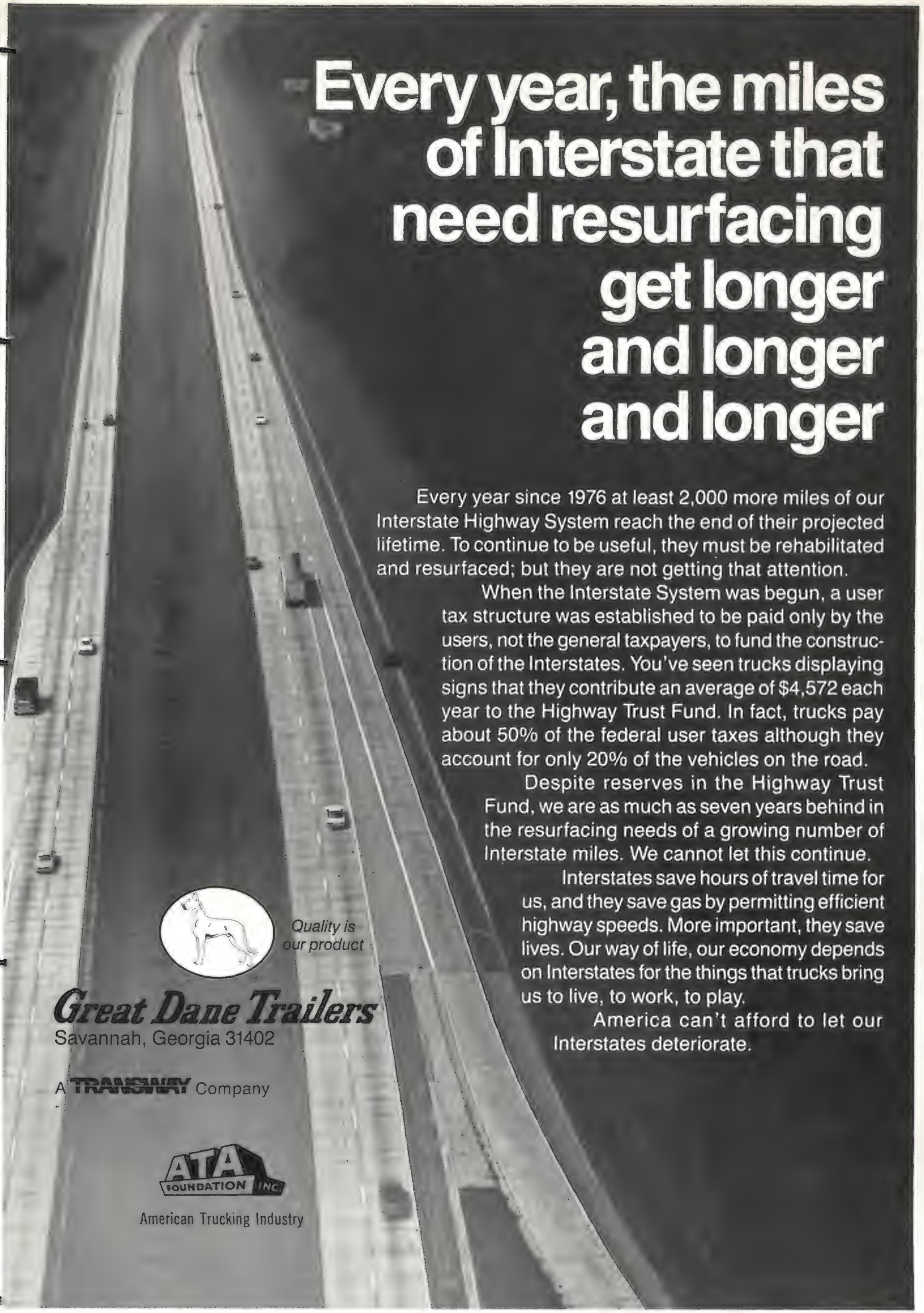

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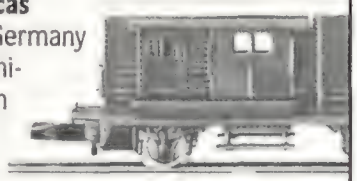

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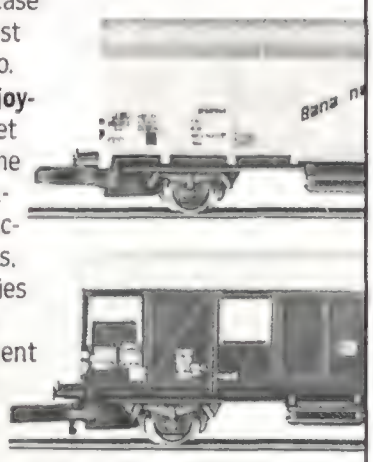

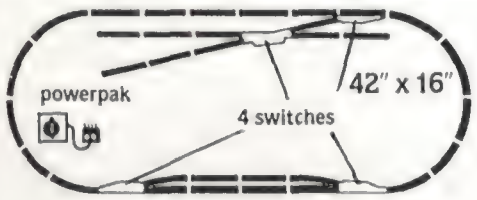

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a handful of the barristers and judges who—after Wilde's case against his lover's father for criminal libel failed—participated in other cases that followed.

In its early years, *Vanity Fair* could easily devour one of its own. Lord Stanhope is described as "the archetype of that respectable mediocrity which is so justly revered by the higher orders in England." Not surprisingly, the magazine grew stuffier with age, becoming a defender of the higher orders.

The strength of its political opinions was greater under Bowles, who left to run for the House of Commons. Perhaps his most lasting creative contribution was "Jehu Junior," who took credit for biographical sketches. Bowles aptly took his pen name from a minor prophet who pronounced the downfall of his enemies and then proceeded to destroy them.

Jehu Junior—whose comments were written by various successors—stayed on after Bowles, continuing to illustrate the virtues and failings of his class. His prejudices were as clear as his loyalties. For instance, he congratulated the barrister who declined the opportunity to cross-examine the Prince of Wales, who perjured himself in a divorce case; and he seemed constitutionally incapable of admiring an Irishman, Scotsman, Frenchman, American or Jew without noting the absence of some objectionable quality usually attributed to his sort.

Matthews and Mellini quite rightly note that the most lackluster series of caricatures to appear in *Vanity Fair* were those of scientists. Since science was not a part of the Establishment, scientists were interpreted in isolation, without the benefit of a larger framework and perspective. Happily, the authors do not have this problem in any of their dealings with *Vanity Fair*.

Randy Sue Coburn
Washington writer and critic

Fragile Paradise: The Discovery of Fletcher Christian, Bounty Mutineer
Glynn Christian
Little, Brown, $19.95

When, as a youngster in New Zealand, Glynn Christian was taken to see the film of *Mutiny on the Bounty*, he had no idea that the character played by Clark Gable was his own great-great-great-great-grandfather. That discovery began a lifelong

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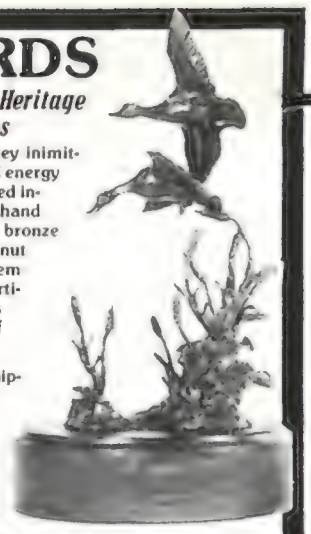

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Before mutiny, Captain Bligh (above) was staunch friend of Fletcher Christian.

fascination with the infamous mutineer, culminating in a voyage to remote Pitcairn Island to hunt for Fletcher Christian's lost remains. In the process of investigating his ancestor, Glynn Christian came upon invaluable papers hidden underneath a grand piano in a family mansion, documents he claimed helped to illuminate the personal relationship between Fletcher Christian and Bligh. And in the process, the contemporary Christian claimed also to have learned "more about my universally recognized but totally unknown ancestor than anyone who has written about him." All of which suggests good reason for yet another book on the *Bounty* incident and its participants.

"Bligh, you are my prisoner!" So spoke the mutinous Mr. Christian to his commanding officer aboard HMS *Bounty* on the morning of April 28, 1789. About that statement most authors of the some 2,500 books and articles regarding the *Bounty* would agree. But what precipitated and what followed upon the events of that day remain clouded.

Glynn Christian has been a scriptwriter, and his retelling of the *Bounty* saga, while scholarly, abounds in the action and atmosphere that I feel both film versions of the story, for all their literary license, sorely lacked. *Fragile Paradise* is also enriched by a thorough accounting of Tahitian mores and the British seafaring life-style. Life in Tahiti (hardly the orgiastic paradise portrayed so often) was a well-structured and healthy existence.

Life at sea was quite another matter. More than one out of seven seamen died

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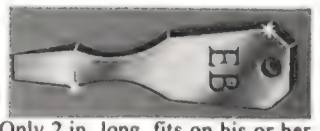

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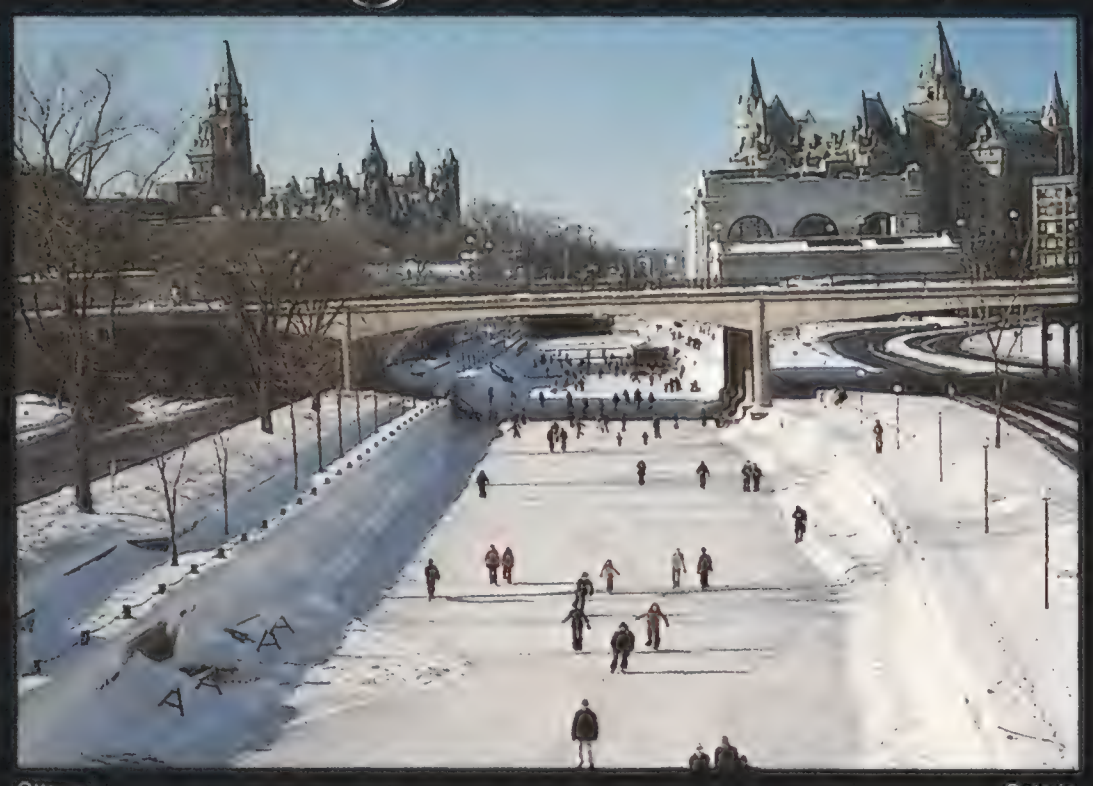

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in service; a higher number jumped ship. The rest subsisted on a diet of wheat-and-pea-flour biscuits dyed white with alum, rock-hard salted pork and beef, a gallon of beer a day, and generous portions of other spirits. The men of the tiny *Bounty* (91 feet long, 24 feet wide) were crowded belowdecks, in windowless cubicles sometimes only five feet high.

In such circumstances, mutinous sentiments were certainly understandable. In fact, mutiny did not seem uncommon. Bligh was involved in other uprisings. Captain Edward Edwards, the man sent to capture Christian, was himself the subject of an uprising. Fletcher Christian's brother, Glynn Christian discovered, also participated in a mutiny.

The author also discovered a possible source of friction between the *Bounty* protagonists—the suggestion of a financial debt Christian owed Bligh. Glynn Christian also reviews the long association of the two men and their apparent friendship, even toying with the notion of an unhappy homosexual relationship as the underlying cause of the rebellion. Ultimately, he rejects the assumption as "totally unsupported by any contemporary evidence." He settles, instead, for a long-accepted line of reasoning: that Bligh's vacillation in applying discipline, and moreover his rages, notably in a missing-coconut harangue of Christian the day before, inspired the mutiny.

Speculations also abound in Christian's account of the Pitcairn massacre. Bligh and his 18 loyalists were cast adrift in an open boat and after a month at sea, they reached the Australian coast. Twelve returned to England alive. But none of those who followed Christian to Pitcairn Island lived to see their homeland again. The makeshift *Bounty* crew of eight seamen, six Polynesian men and a dozen women, and their 25-year-old leader landed on the isolated and incorrectly charted shores of Pitcairn after a four-month journey of nearly 8,000 miles. There they lived, bred, and in large numbers died, without discovery for two decades. When the American whaler *Topaz* raised Pitcairn in 1808, its crew found but one adult male, a European, and four Tahitian women amidst a colony of children and teen-agers. At some time, somehow, Christian and the other men had disappeared. Evidence pointed to another mutiny on shore, this time a

revolt by the oppressed Polynesian men.

Glynn Christian raises alternative solutions proposed in the past. Did Fletcher Christian survive the attack and take refuge in the cliffs? Did he escape to live in obscurity in Britain? Both of these intriguing surmises are chewed over and ultimately spat out by the author, but not without regret for a progenitor whose "hot, pioneering courage and imagination . . . made him worthy of a far more dramatic end than that of perishing with his broken head clubbed into the warm, red earth of Pitcairn."

The dogged investigation of Glynn Christian is also worthy of a better end than that of *Fragile Paradise*, which concludes with a highly personal and discursive reminiscence of the author's voyage to Pitcairn Island. His trip approved by the Royal Geographical Society, Christian was charged with mapping the island. He did not, however, have any success uncovering his ancestor's grave nor in reaching Marlon Brando, a former Christian-player. While the lives of those he did encounter, the native Pitcairnites, a friendly group of three-score Seventh-Day Adventists, makes a pleasant diversion, it is a disturbing change from the book's historical tone.

But this clumsy coda is not enough to disturb *Fragile Paradise*'s fascination, nor is the author's presupposition that readers are familiar with the *Bounty* story. As an addition to Sir John Barrow's classic *The Mutiny of the 'Bounty'* or Charles Nordhoff's and James Norman Hall's faithful novelization (now being republished on its 50th anniversary), *Fragile Paradise* is a delightful excursion.

Don Lessem
Staff writer, *Worcester Magazine*

Teaching a Stone to Talk; Expeditions and Encounters
Annie Dillard
Harper & Row, $12.95

As readers who enjoyed her Pulitzer Prize-winning earlier work, *Pilgrim at Tinker Creek*, will recall, Annie Dillard sees the world around her with a penetrating eye. And having seen it, having assimilated it, she presents it to us in a refreshing new dimension.

Take, for example, her recollection of a swarm of finches in the Galápagos islands: "They fell in from every direction

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like colored bits in a turning kaleidoscope. They whirled and homed to a vortex, like a whirlwind of chips, like draining water. The tree on which I leaned was the vortex. A dry series of puffs hit my cheeks. . . . The lighting birds were rocking the tree. It was an appearing act: before there were barren branches; now there were birds like leaves."

She is often amused, as in this glimpse of a priest who was taking part in an ecumenical service: "The priest, new to me, was in his sixties. . . . When he knelt at the altar, and when he rose from kneeling, his knees cracked. It was a fine church music, this sound of his cracking knees."

Throughout, she speculates on our perplexing relationship to the natural world. The title essay tells of a neighbor of hers, perhaps slightly deranged, who is trying patiently to get a stone—which he keeps in a leather pouch—to speak. Well, why not? she asks. For nature has its way of communicating with us, and its very silence often speaks volumes. "Did the wind use to cry, and the hills shout forth praise? Now speech has perished from among the lifeless things of earth, and living things say very little to very few. Birds may crank out sweet gibberish and monkeys howl. . . . But so do cobbles rumble when a wave recedes. . . . I call these noises silence. It could be that wherever there is motion there is noise . . . and wherever there is stillness there is the still small voice, God's speaking from the whirlwind, nature's old song and dance, the show we drove from town."

If we cannot explain nature, she says, we must at least witness it.

Her own watching is masterfully told. Once she and her husband climbed a bleak hilltop in the Pacific Northwest to observe an eclipse of the sun. "The sun was going," she remembers, "and the world was wrong. The grasses were wrong; they were platinum. Their every detail of stem, head, and blade shone lightless and artificially distinct as an art photographer's platinum print. This color has never been seen on earth. . . ."

The moment of the eclipse itself was awesome. "At once this disk of sky slid over the sun like a lid. The sky snapped over the sun like a lens cover. The hatch in the brain slammed. Abruptly it was dark night, on the land and in the sky. . . . There was no sound. The eyes dried, the

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arteries drained, the lungs hushed. There was no world. We were the world's dead people rotating and orbiting around and around, embedded in the planet's crust, while the earth rolled down." Time seemed to stop. "We had all died in our boots on the hilltops of Yakima, and were alone in eternity. . . . Oh, and then the orchard trees withered, the ground froze, the glaciers slid down the valleys and overlapped the towns. If there had ever been people on earth, nobody knew it."

Not all her imagery is filled with such foreboding. Again and again she makes inconsequential happenings vivid and pleasing. In the book's last paragraph she describes a sudden, brief "ripple of wind" that interrupts a summer's heat. "We see a wave of shadow and gloss where the short grass bends and the cottage eaves tremble. It hits us in the back. It is a single gust, a sport, a rogue breeze out of the north. . . . Who authorized this intrusion? Stop or I'll shoot. It is an entirely misplaced air. . . . The gust crosses the river and blackens the water where it passes, like a finger closing slats."

"I have a taste for solitude, and silence," Annie Dillard has written earlier. Of such a taste and such a sensibility, her book is a lucid witness.

Oliver Allen
New York writer and editor

Dorothy Day
William D. Miller
Harper & Row, $18.95

Dorothy Day, the founder and spiritual center of the Catholic Worker movement, was a loner who guarded her privacy, even though she readily confided her thoughts to a series of handwritten journals for more than four decades. Near the end, she gave it all to her trusted friend William D. Miller in 1975 to do with as he thought best.

As one who knew Dorothy Day, I could fault Miller for his failure to analyze the abundant data given him in this treasure trove, but this view would not do justice to his deliberate decision to record extensively, sometimes tediously, but without critical comment, the facts of her life.

After two common-law unions, one brief marriage, one abortion and the birth of a daughter whom she named Tamar, Dorothy decided in 1927 that she and the Roman Catholic Church

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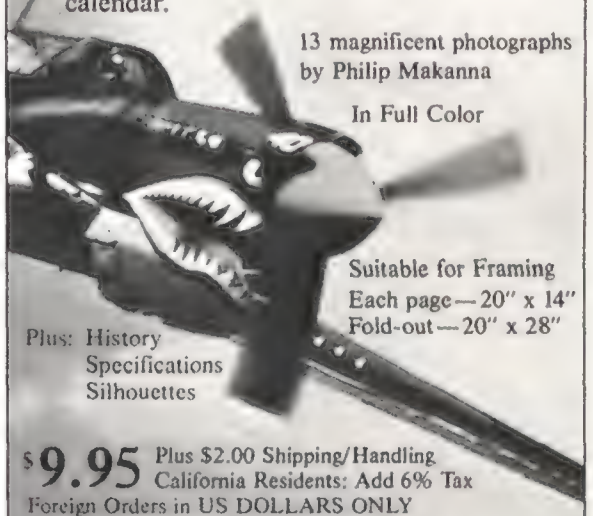

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were made for and would understand each other.

Early in her career as a journalist, writing first for the *Call*, a socialist newspaper published in New York, and later as an editor, with Max Eastman, of *The Masses*, Dorothy developed a habit of dropping into Catholic churches alone at odd hours. All this during her Bohemian period in Greenwich Village, where her circle of friends and acquaintances included Eugene O'Neill, Malcolm Cowley, Mike Gold, John Reed, Allen Tate, Hart Crane, Caroline Gordon, Kenneth Burke and John Dos Passos.

These bonds quickly weakened when Dorothy met Peter Maurin, the eccentric, saintly French peasant whom she credited with giving focus and purpose to her new life as a Catholic. She once described him as "a genius, a saint, an agitator, a writer, a lecturer, a poor man, and a shabby tramp, all in one."

In later years she credited Maurin with being the founder of the Catholic Worker movement, although it is probably more accurate to say that she deserves the credit for founding *The Catholic Worker* newspaper and that the "houses of hospitality," a trademark of the movement, were his idea.

Miller's book is neither a commissioned biography nor a "puff job." But it deliberately and repeatedly avoids analysis of what can only be called flaws in the character of an admittedly great but complex woman.

Both before and after her religious conversion Dorothy Day ministered to the needs of the poor. She wore secondhand clothing. She rode buses coast-to-coast to visit the houses of hospitality at the height of the movement, and she went to jail as often as her conscience told her it was necessary to witness for the gospel of peace and justice.

But she also prayed to be rid of her habit of dominating others. She was thin-skinned and took a long time to forget injuries. She never registered to vote and thus never cast a vote in any election. She had no time for small talk, did not suffer fools gladly, did not feel obligated to explain her own shifts in opinion, and felt badly used by her associates when their differences with her probably resulted from her own casual style of administration. There is no evidence in Miller's book that she had any sense of humor whatsoever.

In words quoted from Dostoevsky, Dorothy says she was "haunted by God." She once said that anyone who hoped to understand the Catholic Worker movement would have to know the works of the great Russian novelist. The organizing principles of her adult life were that life on this Earth is but a prelude to eternal union with God in the kingdom of heaven; and that generous ministry to the poor, the sick and the disenfranchised in this life is a duty for all persons who would call themselves the followers of Christ.

Miller has made himself fully conversant with the abundant materials given him by Dorothy Day and he has used these materials with discretion and with courtesy to her memory. He has provided a useful guide for those who would probe more deeply into the life of a great woman who has been knowledgeably called "the radical heart and conscience of American Catholicism."

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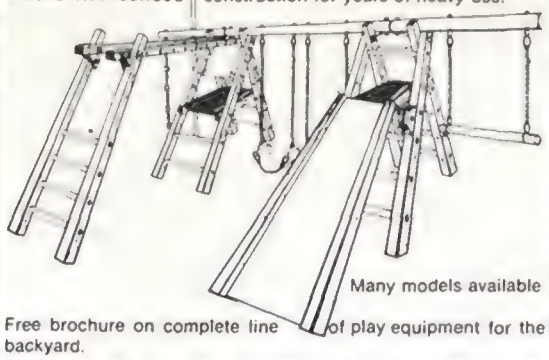
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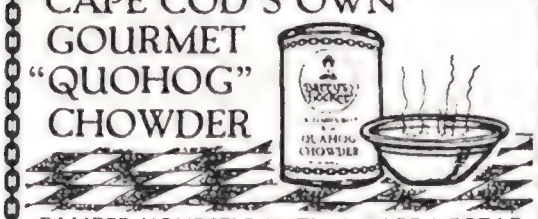
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Uffizi Gallery (p. 58)

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The Uffizi and Pitti, Florence by Filippo Rossi, Abrams, 1967

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The Deer of North America by Leonard Lee Rue III, Crown Publishers, 1978

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Special November exhibits and events

National Air and Space Museum

James Webb: The Man behind Apollo New exhibit includes bust of the former Administrator of NASA by sculptor Frederick Hart.

The Artist and the Space Shuttle (December 1-August 1983) Artists' impressions of Space Shuttle program from 1977 to 1981.

Poetry in Motion (November 18; 7:30 P.M.) Air Commodore Ronald Dick discusses demonstration flying, beginning with "crazy flying" of the early 1920s.

Extremes of the Solar System (November 6; 9 A.M.) Monthly sky lecture.

Hirshhorn Museum & Sculpture Garden

David Smith: Painter, Sculptor, Draftsman (November 4-January 2, 1983) Major exhibition includes his paintings and drawings in addition to sculptures.

David Smith: A Symposium (November 6) Joint all-day program with National Gallery of Art features major critics.

National Portrait Gallery

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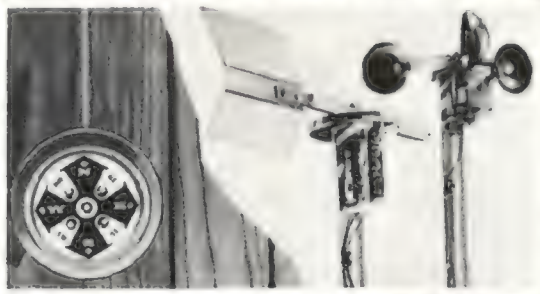

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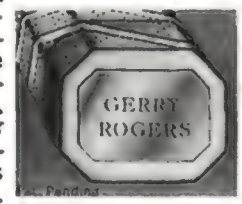

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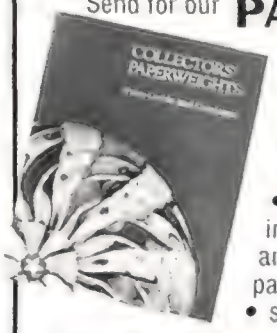

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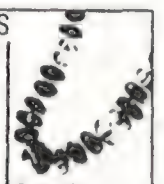

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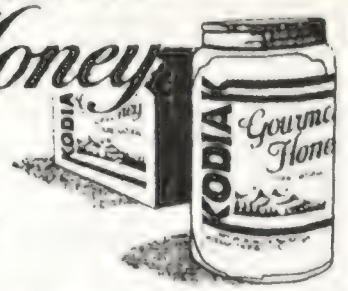

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The extravagant and often gaudy picture palaces were America's great escape during the 1920s and 1930s

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The great palaces have met a mixed fate since their heyday. All too many fell into disrepair and were razed. Others have been restored or preserved, often by groups of interested citizens, and are still used for movies or performing-arts events. The rest were adapted to serve the changing—and less fantasy-filled—times, becoming, in one city, a restaurant; in another, a bowling alley; and—in Detroit, naturally—a parking lot.
Constance Bond

Classical elements take on fantastic aura at Keith's in Flushing, New York.

The Avalon, a 1929 Art Deco theater on Catalina Island, still shows films.

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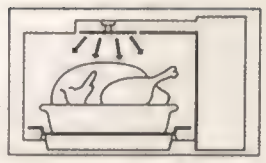

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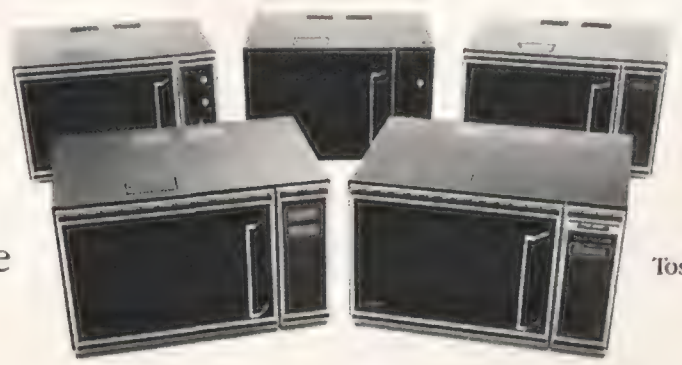

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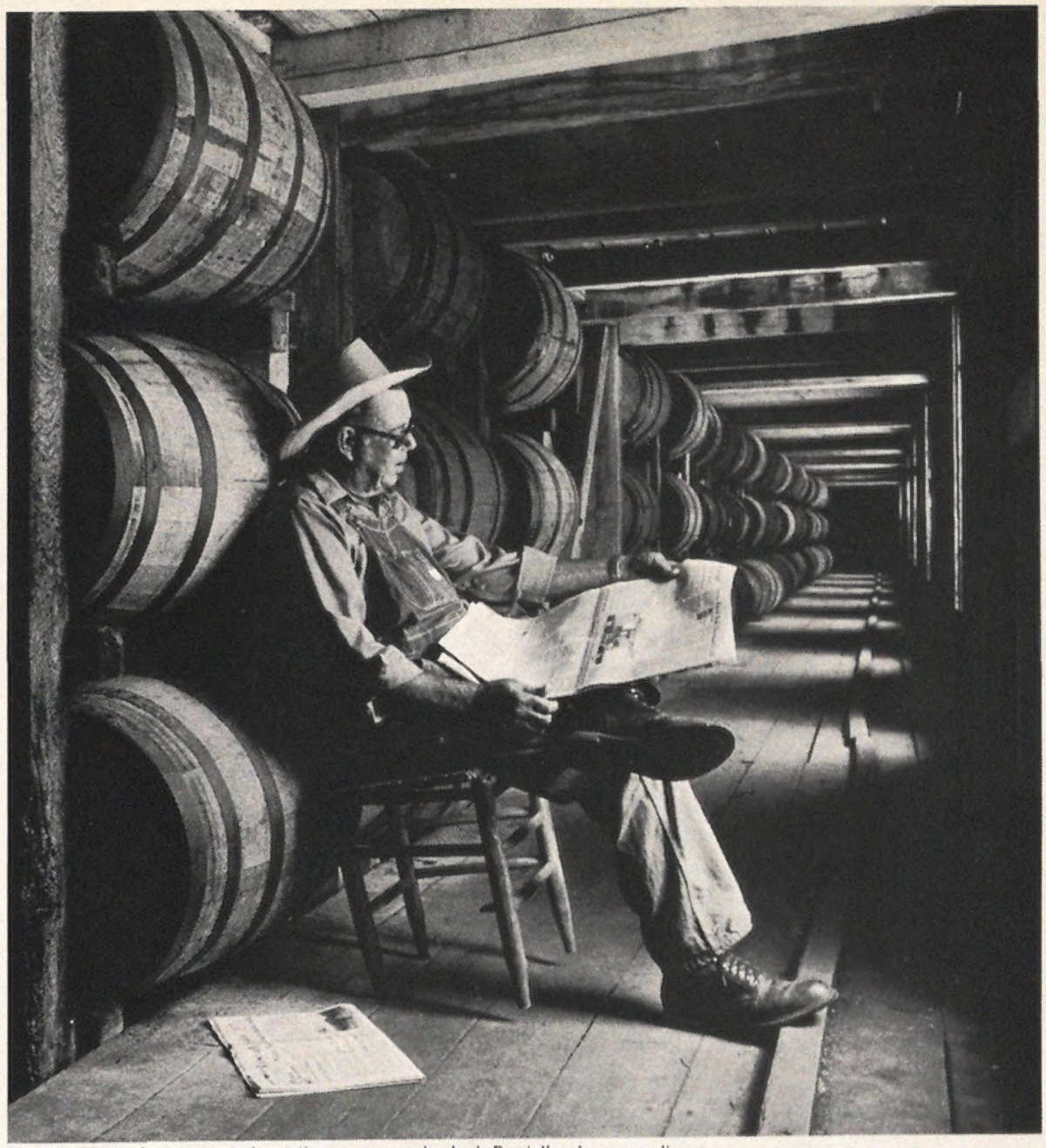

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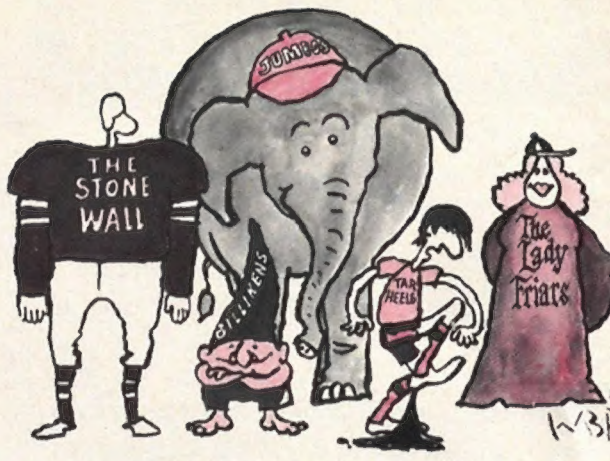
By W. Patrick Resen

What, you ask, is a Hoya? Better you don't ask



With the college basketball season rapidly approaching, I recently found myself thinking once again of the Hoyas. Last year this classy Georgetown University team wound up No. 2 in the NCAA tournament. This year we're apt to be hearing a lot about them again, and this started me wondering: what in the world *is* a Hoya, and why in the world did Georgetown adopt that crazy nickname for its teams? "What" was a good question, for that, I learned on checking, is what "hoya" means.

Sometime in the dim past the student body took to calling one of its athletic teams "The Stonewalls." Being of an academic bent, as college students occasionally are, and being enmeshed in a Jesuit classical education, they began to refer to their teams in a combination of Greek (*hoya* for "what") and Latin (*saxa* for "rocks"), a rather rough translation of stonewall. The team and/or the students evidently liked being known as "what rocks," but the term became both corrupted and shortened to "Hoyas." (Why a school would want to be known as the "whats," on the rocks or not, who knows?)

But that wasn't enough. The team that the Hoyas played for the NCAA championship is styled the Tar Heels. There appear to be many myths as to how the state and thus the University of North Carolina athletic teams came upon this. One is that North Carolina was a major tar-and-turpentine producing area and the pre-1776 British noticed the "tar heels" of the workers in the industry. A more colorful attribution pertains to Civil War days. Supposedly General Robert E. Lee—or was it Jefferson Davis or Stonewall Jackson?—noticed the tenacity of a North Carolina fighting unit and commented: "Look at those North Carolina boys; they stick to their posts as if they have tar on their heels!"

All of this, however, only whetted my curiosity all the more. What (or hoya), I wondered, were some other unusual team nicknames?

There really is a Siwash, I discovered. Older readers might recall the fictional school by that name in George Fitch's stories of about 50 years past. Fitch was an alumnus of Knox College (Galesburg, Illinois) and in recognition of the writing success of its graduate, it adopted "Siwash" as its nickname. St. Louis University teams are the Billikens, a wholly fabricated title. A Billiken is a squattish-looking creature, created as a good luck piece by one Florence Prentz of Kansas City. Apparently the football coach of the era, John Bender, resembled the fellow and the team became Bender's Billikens, later simply the Billikens.

Tufts University, of Massachusetts, has one of my favorites—the Jumbos. P. T. Barnum was a trustee of the college and, upon the death of Jumbo, the big elephant (SMITHSONIAN, May 1982), he had the carcass stuffed and presented to the school. The remains were destroyed in a 1975 fire, but the name lives on.

Others I like are the Williams College (Massachusetts) Ephs, for Ephraim Williams, who founded the college; and the Millsaps (Mississippi) Majors, also named for the founder, Major Millsaps. (Millsaps is a Division III team; if they advance to Division II competition, they might get promoted to the Millsaps Colonels.) New Hampshire College teams go by the name Penmen, which is apropos for a college that started as a business school. Of course, if they were to start as a business school these days, they might have to be called the Computers.

Amherst College in Massachusetts was named for Lord Jeffrey Amherst, a soldier of renown in the French and Indian Wars, so their team nickname is Lord Jeffs—a rather pleasing combination of prerevolutionary title and post-Revolution informality. And athletes of Manhattan College in New York go by the name Jaspers, in memory of Brother Jasper, of the faculty, who was very involved with the athletic teams and who, among other things, invented the seventh-inning stretch, certainly a creation worth being remembered for.

There are more that are just plain pleasing. The Allentown (Pennsylvania) Centaurs; the California-Irvine Anteaters; the Campbell (North Carolina) Fighting Camels. Catholic University teams are the Cardinals, but probably in honor of the bird, not the prelate.

But some schools are just misnamed and something should be done about it. It's fine that there are lots of Falcons. It's just perfect for the Air Force Academy, but for Friends University in Kansas? Shouldn't they be the Quakers, or the Pals? Really, now—much too aggressive. And Bishop College of Texas: the Fighting Tigers just doesn't go with the image of the miter. They really blew it at the Coast Guard Academy—the Bears? How about the Cutters? And for Virginia Union—the Suits?

And women's teams: I confess that I don't understand how Central Florida can have Lady Knights instead of Ladies, or why the female athletes at Cornell College in Iowa are still Rams, not Ewes. And does the Pope know about the Providence College Lady Friars, who are in Rhode Island?

But my favorite is not the Akron Zips or the Boston Terriers. It belongs to Centenary College of Louisiana: the Gentlemen. Sets the right tone, I think, but it must inhibit the cheering. After all, one can't yell "Gents, kill the opposition!"

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